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INTRODUCTION TO

NUCLEAR SCIENCE ABSTRACTS

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Nuclear Science Abstracts is issued twice a month throughout the calendar year by the Atomic Energy Commission. It is intended primarily to serve scientists and engineers working within the Atomic Energy Project by abstracting as completely and as promptly as possible the literature of nuclear science and engineering. It covers not only the unclassified and declassified research reports of the Atomic Energy Commission and its contractors, but also material in its field of interest which appears in technical and scientific journals and unpublished research reports of government agencies, universities, and industrial research establishments.

DECLASSIFICATION

The issuance of these Abstracts does not constitute authority for declassification of any reports.

INDEXES

Nuclear Science Abstracts is indexed by author, subject, and report number. Annual index issues are prepared for each volume, and the next cumulated index will appear in volume 10(1956) covering volumes 5-10. A cumulated index to volumes 1-4 was issued as volume 4, No. 24B, Dec. 30, 1950 covering authors, subjects, nuclides, and report numbers. The 24th number of volumes 5, 6, and 7 contain indexes covering the individual volumes and a cumulated Numerical Index of Reports covering Abstracts of Declassified Documents, Vols. 1 and 2, as well as the previously issued NSA volumes.

Each issue of Vol. 8(1954) contains a numerical index and an author index to abstracts in that issue. Subject and author indexes covering the first six-month period are issued as a supplement to the twelfth issue. The 24th issue will be the annual index for the volume.

In addition to conventional abstracts, Nuclear Science Abstracts carries in issues 6B, 12B, 18B, and 24B lists of New Nuclear Data in which experimental results are displayed in tabular form and arranged by element and isotope. Each data item includes a reference. In 1954 each list will be cumulated in Vol. 8, No. 24B. New Nuclear Data is compiled by the Nuclear Data Group of the National Research Council, Washington 25, D. C. The data items are also supplied by this group on 3 × 5″ cards for $20.00 per year domestic and about $30.00 per year foreign (air mail postage included).

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RESEARCH AND DEVELOPMENT REPORTS

How to Locate Reports. The Numerical Index of Reports appearing in each issue indicates the declassified and unclassified research reports which have been abstracted in the current issue of Nuclear Science Abstracts.

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Reports Not Published. AEC reports for which no sale price or literature citation is given are obtainable on loan at the depository libraries. The complete series (NSF-tr) of National Science Foundation translations is also available at the depository libraries.

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NUCLEAR SCIENCE ABSTRACTS

Vol. 8, No. 9, May 15, 1954

TABLE OF CONTENTS

Category	Abstract	Page
SELECTED SUBJECTS OF INTEREST TO INDUSTRY		iv
GENERAL	2274	275
Research Programs	2275	
BIOLOGY AND MEDICINE	2276	275
Aerosols	2281	
Radiation Effects	2282	
Radiation Hazards and Protection	2307	
Radiotherapy	2311	
Tracer Applications	2313	
CHEMISTRY	2321	281
Analytical Procedures	2344	
Crystallography and Crystal Structure	2353	
Deuterium and Deuterium Compounds	2354	
Fluorine and Fluorine Compounds	2355	
Graphite	2358	
Laboratories and Equipment	2361	
Molecular Structure	2362	
Radiation Chemistry	2364	
Radiation Effects	2369	
Rare Earths and Rare-earth Compounds	2370	
Separation Procedures	2373	
Sorption Phenomena	2375	
Spectroscopy	2376	
Syntheses	2378	
Tracer Applications	2387	
Transuranic Elements and Compounds	2388	
Tritium and Tritium Compounds	2391	
Uranium and Uranium Compounds	2392	
Waste Disposal	2400	
ENGINEERING	2401	290
Heat Transfer and Fluid Flow	2404	
Materials Testing	2409	
Vacuum Systems	2412	
MINERALOGY, METALLURGY, AND CERAMICS		292
Ceramics and Refractories	2413	
Corrosion	2421	
Geology and Mineralogy	2422	
Metals and Metallurgy	2430	
PHYSICS	2479	300
Cosmic Radiation	2506	
Crystallography and Crystal Structure	2516	
Electrical Discharge	2520	
Electrons	2521	
Gases	2528	
Instruments	2530	
Mass Spectrography	2535	
Mathematics	2538	
Measuring Instruments and Techniques	2541	
Mesons	2577	
Molecular Properties	2589	
Neutrons	2593	
Nuclear Physics	2594	
Nuclear Properties	2596	
Nuclear Reactors	2625	
Nuclear Transformation	2626	
Particle Accelerators	2650	
Radiation Absorption and Scattering	2661	
Radiation Effects	2686	
Radioactivity	2690	
Rare Earths and Rare-earth Compounds	2705	
Shielding	2707	
Spectroscopy	2709	
Theoretical Physics	2716	
Tritium and Tritium Compounds	2730	
Uranium and Uranium Compounds	2732	
NUMERICAL INDEX OF REPORTS		INDEX-1

SELECTED SUBJECTS OF INTEREST TO INDUSTRY

All AEC reports abstracted in this issue of Nuclear Science Abstracts have been reviewed and evaluated in terms of their interest and usefulness to general industry. These reports are listed below by title, author, and report number under one or more of the following nine broad categories: Chemistry and Chemical Engineering; Construction and Civil Engineering; Electronics and Electrical Engineering; Health and Safety; Industrial Management; Mechanics and Mechanical Engineering; Metallurgy and Ceramics; Mining and Geology; and Nuclear Technology. The abstract number for each report is listed at the upper right of the entry and refers to an item in the current issue of NSA.

All unclassified reports considered to be of special interest to general industry issued by the AEC prior to July, 1953 are listed or abstracted in a series of bibliographies (TID-3050), the titles of which correspond to the above-mentioned categories. As these background bibliographies become available for sale, the prices will appear in the Numerical Index of Reports which is included in each issue of this volume of NSA. These bibliographies may be purchased from the U. S. Department of Commerce, Office of Technical Services, Washington 25, D. C.

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CHEMISTRY AND CHEMICAL ENGINEERING

AECU-2818 2400
Los Alamos Scientific Lab.
DESIGN AND PERFORMANCE OF AN EFFLUENT PLANT FOR RADIOACTIVE WASTES. J. A. Leary, R. A. Clark, and R. P. Hammond. Jan. 20, 1954. 20p. Contract [W-7405-eng-36]. (AECU-2818)

HW-30050 2345
Hanford Works
COULOMETRIC DETERMINATION OF PHOSPHATE. W. N. Carson, Jr. and H. S. Gile. Nov. 19, 1953. Decl. Feb. 8, 1954. 9p. Contract W-31-109-Eng-52. (HW-30050)

IDO-16124 2530
Phillips Petroleum Co., Atomic Energy Div.
A ROD-TYPE THERMISTOR CALORIMETER. E. E. Burdick. Oct. 26, 1953. Decl. Mar. 2, 1954. 11p. Contract AT(10-1)-205. (IDO-16124)

K-1086 2396
Carbide and Carbon Chemicals Co. (K-25)
THERMAL DECOMPOSITION OF URANYL NITRATE HEXAHYDRATE. W. S. Wendolkowski and S. S. Kirslis. Feb. 22, 1954. 23p. Contract W-7405-eng-26. (K-1086)

LA-1622 2370
Los Alamos Scientific Lab.
PREPARATION OF MASSIVE SAMARIUM METAL. E. I. Onstott. Dec. 1953. 8p. Contract W-7405-eng-36. (LA-1622)

NYO-3737 2410
Columbia Univ.
PRELIMINARY INVESTIGATION OF "ANTI-WHIRL" BEARINGS FOR OPERATION IN AN ACIDIC SOLUTION CONTAINING ABRASIVE PARTICLES. Carl F. Kayan, Gilbert F. Boeker, Dudley D. Fuller, Robert Corry, Beno Sternlicht, and Peter Tea. Dec. 15, 1953. 76p. Contract AT(30-1)-1274. (NYO-3737)

TID-3046 2275
Technical Information Service, AEC
UTILIZATION OF GROSS FISSION PRODUCTS. A BIBLIOGRAPHY OF UNCLASSIFIED REPORT LITERATURE. Gifford A. Young, comp. Feb. 1954. 32p. (TID-3046)

UCRL-377 2329
Radiation Lab., Univ. of Calif., Berkeley
ZIRCONIUM THENOYLTRIFLUOROACETONATE: SOLUBILITY AND EXTRACTION. E. H. Huffman and G. M. Iddings. June 17, 1949. Decl. Nov. 16, 1953. 10p. Contract W-7405-eng-48. (UCRL-377)

UCRL-2389 2389
Radiation Lab., Univ. of Calif., Berkeley
VAPOR-PRESSURES OF AMERICIUM TRIFLUORIDE AND AMERICIUM METAL (thesis). Stephen Charles Carniglia. Nov. 1953. 76p. Contract W-7405-eng-48. (UCRL-2389)

UR-315 2397
Atomic Energy Project, Univ. of Rochester
POLYMERIZATION OF URANYL-CITRATE,-MALATE,-TARTRATE, AND -LACTATE COMPLEXES. I. Feldman, J. Havill, and W. Neuman. Feb. 23, 1954. 28p. Contract W-7401-eng-49. (UR-315)

ELECTRONICS AND ELECTRICAL ENGINEERING

AECU-2795 2479
David Sarnoff Research Center
ELECTRONIC DEVICES FOR NUCLEAR PHYSICS. QUARTERLY REPORT NO. 13 [FOR] JULY 1953–OCTOBER 1953. G. A. Morton, P. W. Davison, D. H. Fetters, M. H. Greenblatt, A. L. Solomon, and A. H. Sommer. Dec. 28, 1953. 17p. Contract W-7405-eng-26, Sub-308. (AECU-2795)

ANL-5174 2480
Argonne National Lab.
PHYSICS DIVISION QUARTERLY REPORT [FOR] SEPTEMBER, OCTOBER, AND NOVEMBER 1953. Feb. 1954. 88p. Contract W-31-109-eng-38. (ANL-5174)

HW-30713 2543
Hanford Works
A PORTABLE SCINTILLATION TYPE ALPHA SURVEY INSTRUMENT. W. G. Spear. Feb. 1, 1954 14p. Contract W-31-109-Eng-52. (HW-30713)

LRL-94 2531
Livermore Research Lab., California Research and Development Co.
MODULATED LIGHT BEAM TELEMETERING OF HIGH POTENTIAL-ISOLATED PULSE SIGNALS. H. J. Strickland. Feb. 1954. 8p. Contract AT(11-1)-74. (LRL-94)

NAA-SR-851 2545
North American Aviation, Inc.
PREPARATION OF INDIUM FOILS ON A SUBSTRATE OF POLYVINYL ACETAL. J. H. Thompson and J. M. Nuding. Mar. 15, 1954. 10p. Contract AT-11-1-GEN-8. (NAA-SR-851)

ORNL-1624 2411
Oak Ridge National Lab.
THE NATURE OF THE FLOW OF ORDINARY FLUIDS IN A THERMAL CONVECTION HARP. D. C. Hamilton, F. E. Lynch, and L. D. Palmer. Mar. 16, 1954. 71p. Contract 7405-Eng-26. (ORNL-1624)

HEALTH AND SAFETY

BNL-264 2307
Brookhaven National Lab.
HEALTH PHYSICS PROGRAM FOR THE BROOKHAVEN COSMOTRON. F. P. Cowan and J. S. Handloser. Nov. 1953. 35p. (BNL-264)

TID-3046 2275
Technical Information Service, AEC
UTILIZATION OF GROSS FISSION PRODUCTS. A BIBLIOGRAPHY OF UNCLASSIFIED REPORT LITERATURE. Gifford A. Young, comp. Feb. 1954. 32p. (TID-3046)

UCLA-274 2285
Atomic Energy Project, Univ. of Calif., Los Angeles
SOME FACTORS INFLUENCING THE METABOLISM OF RADIO-STRONTIUM BY ANIMALS. Warren J. Gross, Janice F. Taylor, and James C. Watson. Issued Jan. 6, 1954. 20p. Contract AT-04-1-GEN-12. (UCLA-274)

UCLA-282 2318
Atomic Energy Project, Univ. of Calif., Los Angeles
FIXATION AND EXTRACTABILITY OF FISSION PRODUCTS CONTAMINATING VARIOUS SOILS AND CLAYS: I. Sr^{89}, Sr^{90}, Y^{91}, Ru^{106}, Cs^{137}, and Ce^{144}. Hideo Nishita, Bruce W. Kowalewsky and Kermit H. Larson. Feb. 23, 1954. 32p. Contract AT-04-1-GEN-12. (UCLA-282)

UR-300 2281
Atomic Energy Project, Univ. of Rochester
TYNDALLOMETRIC ESTIMATION OF POLYDISPERSE AEROSOL DEPOSITION IN MAN. John A. Hilcken. Feb. 12, 1954. 161p. Contract W-7401-eng-49. (UR-300)

MECHANICS AND MECHANICAL ENGINEERING

KAPL-924 2401
Polytechnic Inst. of Brooklyn
DEFORMATIONS AND STRESSES IN CIRCULAR CYLINDRICAL SHELLS CAUSED BY PIPE ATTACHMENTS. PART 4. WORK CHARTS. Joseph Kempner. Feb. 1953. 72p. Contract W-31-109-eng-52, Subcontract K-130 to Knolls Atomic Power Lab. (KAPL-924)

LA-1590 2625
Los Alamos Scientific Lab.
HEAT TRANSFER AND THERMAL STRESSES IN NUCLEAR REACTOR SHELLS. Franklin P. Durham. Sept. 1953. Decl. Feb. 2, 1954. 20p. Contract W-7405-eng-36. (LA-1590)

METALLURGY AND CERAMICS

BMI-903 2431
Battelle Memorial Inst.
THE STRENGTH OF WROUGHT ZIRCONIUM-BASE BINARY ALLOYS AT 1800 TO 2200 F. H. A. Saller, J. T. Stacy, and S. W. Porembka. Feb. 17, 1954. 22p. Contract W-7405-Eng-92. (BMI-903)

BMI-X-112 2432
Battelle Memorial Inst.
A METHOD OF MEASURING THE CONTRIBUTION OF CRYSTAL STRUCTURE TO THE HARDNESS OF METALS. W. Chubb. [1953]. Decl. Mar. 9, 1954. 21p. Contract W-7405-eng-92. (BMI-X-112)

KAPL-1049 2433
Knolls Atomic Power Lab.
MECHANICAL PROPERTIES OF BERYLLIUM. (SUBPROJECT NO. 4). E. E. Baldwin and R. F. Koenig. Feb. 15, 1954. 65p. Contract W-31-109-eng-52. (KAPL-1049)

NAA-SR-861 2434
North American Aviation, Inc.
EFFECT OF COLD WORK ON THE MAGNETIC SUSCEPTIBILITY OF COPPER AND ALUMINUM. J. D. McClelland. Mar. 15, 1954. 11p. Contracf AT-11-1-GEN-8. (NAA-SR-861)

NYO-3963 2446
Columbia Univ. School of Mines
THE STUDY OF DIFFUSIONLESS PHASE CHANGES IN SOLID METALS AND ALLOYS. PROGRESS REPORT FOR THE PERIOD JUNE 1 TO AUGUST 31, 1953. T. A. Read, D. S. Lieberman, M. S. Wechsler, and C. W. Chen. Jan. 1954. 4p. Contract AT-(30-1)-904. (NYO-3963; CU-14-53-AEC-904-Met.)

NYO-7038 2449
Massachusetts Inst. of Tech.
X-RAY MEASUREMENTS OF LOCAL ATOMIC ARRANGEMENTS IN Al–Zn AND IN Al–Ag SOLID SOLUTIONS. P. S. Rudman and B. L. Averbach. Dec. 1, 1953. 27p. Contract AT(30-1)-1002, Scope 2, Technical Report No. 19. (NYO-7038)

ORNL-1667 2326
Oak Ridge National Lab.
ALKALI METAL-NICKEL OXIDES CONTAINING TRIVALENT NICKEL. [PERIOD COVERED] JANUARY 1952–JULY 1953. L. D. Dyer, B. S. Borie, Jr., and G. P. Smith. Mar. 15, 1954. 14p. Contract W-7405-eng-26. (ORNL-1667)

ORNL-1681 2327
Oak Ridge National Lab.
SOME PROPERTIES OF HAFNIUM OXIDE, HAFNIUM SILICATE, CALCIUM HAFNATE AND HAFNIUM CARBIDE. C. E. Curtis, L. M. Doney, and J. R. Johnson. Mar. 15, 1954. 36p. Contract No. W-7405-eng-26. (ORNL-1681)

SEP-142 2450
Sylvania Electric Products Inc., Atomic Energy Div.
LUBRICANTS AND FRICTION IN POWDER METALLURGY. I. Sheinhartz, H. M. McCullough, and J. L. Zambrow. Jan. 11, 1954. 12p. Contract AT-30-1-GEN-366. (SEP-142)

NUCLEAR TECHNOLOGY

LA-1590 2625
Los Alamos Scientific Lab.
HEAT TRANSFER AND THERMAL STRESSES IN NUCLEAR REACTOR SHELLS. Franklin P. Durham. Sept. 1953. Decl. Feb. 2, 1954. 20p. Contract W-7405-eng-36. (LA-1590)

UCRL-2412 2506
Radiation Lab., Univ. of Calif., Berkeley
PART A: A CLOUD-CHAMBER STUDY OF COSMIC-RAY AIR SHOWERS AT SEA LEVEL. PART B: A DIFFUSION CLOUD CHAMBER OF UNUSUALLY LARGE DIMENSIONS (thesis). Kenneth E. Relf and Wilson M. Powell. Nov. 1953. 115p. Contract W-7405-eng-48. (UCRL-2412)

NUCLEAR SCIENCE ABSTRACTS

Vol. 8 May 15, 1954 No. 9

An asterisk preceding the abstract number indicates that the corresponding report is included in the "Selected Subjects of Interest to Industry" section of this issue.

GENERAL

2274
Technical Information Service, AEC
ABBREVIATIONS OF PERIODICALS CITED IN PUBLICATIONS ISSUED BY THE TECHNICAL INFORMATION SERVICE, OAK RIDGE. Gifford A. Young and Simone B. Schwind, comps. Dec. 1953. 19p. (TID-3045)

A partial list of periodicals referred to in various publications of the AEC Technical Information Service, Oak Ridge, is presented. It is intended as a tool for the identification of periodicals cited in these publications, and as a guide to abstractors, bibliographers, and report editors in the establishment of abbreviations for unlisted journals. Periodicals included in "List of Periodicals Abstracted by Chemical Abstracts" have been omitted. A bibliography of selected references is appended. (auth)

RESEARCH PROGRAMS

*2275
Technical Information Service, AEC
UTILIZATION OF GROSS FISSION PRODUCTS. A BIBLIOGRAPHY OF UNCLASSIFIED REPORT LITERATURE. Gifford A. Young, comp. Feb. 1954. 32p. (TID-3046)

In order to realize the important potential benefits to industry, the general public, and the Atomic Energy Commission of industrial utilization of the waste fission products from nuclear reactors, the Commission has instituted research programs at various universities and institutions designed to develop uses for these products. Both practical applications of intense radiation and fundamental studies of chemical, physical, and biological effects of radiation are in progress. All unclassified reports related to this program that have been issued up to January 1, 1954 by the cooperating establishments are abstracted in this bibliography of 92 references. (auth)

BIOLOGY AND MEDICINE

2276
Brookhaven National Lab.
A PHYSICAL ORGANIC APPROACH TO ENZYMATIC MECHANISMS. Daniel E. Koshland, Jr. [1953] 10p. (BNL-1693)

2277
Brookhaven National Lab.
THE EFFECTS OF ACTH AND CORTISONE UPON ACQUIRED IMMUNITY TO TRICHINOSIS IN MICE. Richard D. Stoner and John T. Godwin. [1953] 10p. (BNL-1721)

2278
Atomic Energy Project, Univ. of Calif., Los Angeles
A STUDY OF PHARMACOLOGY OF FERRITIN. Thomas J. Haley and James L. Leitch. Feb. 26, 1954. 17p. Contract AT-04-1-GEN-12. (UCLA-284)

Ferritin antisera can be produced in the rabbit, but these antisera show little cross reactivity to ferritins from other species. Due to liver inactivation, ferritin does not sensitize the guinea pig and ferritin has little or no effect on the isolated guinea pig heart, on the pressor response to epinephrine in the rabbit, cat, or dog, on the respiration of the same species, on the response of the cat nictitating membrane to preganglionic cervical sympathetic stimulation or epinephrine injection, on blood flow in the dog's hind limb, or on the response of the isolated guinea pig seminal vesicle to epinephrine. Ferritin does modify the epinephrine response of the isolated rat seminal vesicle, but only at doses of ferritin beyond those usually encountered physiologically. (auth)

2279
Atomic Energy Project, Univ. of Calif., Los Angeles
THE USE OF THE ISOLATED RAT SEMINAL VESICLE FOR THE ASSAY OF ADRENERGIC BLOCKING DRUGS. James L. Leitch, C. S. Liebig, and Thomas J. Haley. Mar. 17, 1954. 15p. Contract AT-04-1-gen-12. (UCLA-285)

The isolated rat seminal vesicle has been shown to give a linear log-dose response curve to both epinephrine and acetylcholine. It was observed that this tissue is more sensitive to the former and completely insensitive to the doses of histamine used. Adrenergic potency can be estimated with the rat seminal vesicle and the results are equivalent to those obtained by other methods. With the preparation, the following order of decreasing adrenergic blocking potency of the various drugs tested was obtained: Dibenzyline, Dibezane, Sy-28, Ergotamine, and Piperoxan. It is possible to determine the degree of drug fixation on the tissue with the method. It has been shown that the B-haloalkylamines have the greatest degree of tissue fixation and the benzodioxans the least, with the ergot alkaloids occupying an intermediate position. (auth)

2280
Radiation Lab., Univ. of Calif., Berkeley
BEHAVIOR, A BALANCED NETWORK OF CHEMICAL TRANSFORMATIONS (BIOKINETICS). D. F. Bradley and M. Calvin. Jan. 13, 1954. 40p. Contract W-7405-eng-48. (UCRL-2443)

While the concept of a biological system as a balanced network of chemical transformations is not a new one, experimental definition of specific systems has been lacking. This paper defines theoretically and experimentally a number of such networks and their behavior and response to some limited environmental changes. (auth)

AEROSOLS

*2281
Atomic Energy Project, Univ. of Rochester
TYNDALLOMETRIC ESTIMATION OF POLYDISPERSE

AEROSOL DEPOSITION IN MAN. John A. Hilcken. Feb. 12, 1954. 161p. Contract W-7401-eng-49. (UR-300)

The general problem posed by the ever-increasing aerosol inhalation hazard is presented. Deposition and retention are defined and previous investigations reviewed. Such optical properties of aerosols as are pertinent to Tyndallometry are briefly considered and Tyndallometers are discussed from the point of view of past use, advantages, and limitation. Following a description of apparatus and procedures, results of Tyndallometric investigations are given including a detailed analysis of the continuous aerosol deposition curve. (auth)

RADIATION EFFECTS

2282

Los Alamos Scientific Lab.

BIOLOGICAL EFFECTIVENESS OF THERMAL NEUTRONS IN PRODUCING TESTICULAR ATROPHY IN MICE. John B. Storer, Wright Langham, Phyllis Sanders, and William Schweitzer. May 1953. 14p. Contract W-7405-eng-36. (LA-1630)

Using testicular atrophy in mice 4 weeks post-exposure as the biological indicator of radiation effect, a comparison was made of the relative effectiveness of thermal column and 250 kvp x radiation. By assuming an RBE of unity for the known γ contaminants associated with exposure to the thermal neutron flux of the Los Alamos Homogeneous Reactor, it was found that $\sim 8 \times 10^9$ thermal n/cm^2 produced an effect equivalent to 1 r of 250 kvp x rays. Depending on assumptions regarding the depth of the testes with regard to the region of peak neutron collision density, calculation of the RBE for thermal neutrons gave values of from 1.2 to 2.5, with 1.3 being the best value obtainable from the present study. (auth)

2283

National Bureau of Standards

THE RELATIVE BIOLOGICAL EFFICIENCY OF DIFFERENT IONIZING RADIATIONS. John W. Boag. Dec. 30, 1953. 147p. (NBS-2946)

The report discusses first some general aspects of the biological effect of different radiations and defines the terms used–dose, relative biological efficiency (RBE), etc. A number of the existing experiments are then reviewed, considering first those on whole animals or organs, and secondly those on microörganisms and other simple materials. The various RBE values reported are tabulated and their bearing on theories of action of radiation is discussed. Finally, the conditions for improved experiments are considered. Appendices give the linear energy transfer distribution in water or tissue irradiated by fast neutrons and by x-ray beams. (auth)

2284

Air Force Radiation Lab., Univ. of Chicago

QUARTERLY PROGRESS REPORT NO. 10. Jan. 15, 1954. 126p. Contract AF-33(038)27353. (NP-5055)

Progress is reported in studies of the application of 5-nucleotidase measurements on the hematopoietic tissues for evaluating the protective efficacy of chemical agents against radiation injury; the applicability of adenosine triphosphatase assays for screening chemical agents for prophylactic or therapeutic value against radiation injury; the influence of x radiation on the metabolism of sulfanilamide in vivo; the influence of x irradiation on O consumption by spleen and thymus gland; the effects of x irradiation on respiration in rat tissue slices; the effects of antihistaminic agents and mouse liver catalase on the lethality of x irradiation in rats; the effects of x irradiation on the neurohumoral mechanisms of the gastrointestinal, hematopoietic, and other tissues of rats; the construction of an acoustic gas analyzer for the continuous quantitative analysis of two-gas anesthetic mixtures; the radiomimicry of hydroxyl radicals; the effects of x irradiation on O consumption and production of CO_2 and acetone by rats, the interpretation of results of tracer experiments in biological systems; the survival of amoeba following multiple lethal doses of x rays, fusion of an x-rayed cell with a nonirradiated cell and halving; the effect of lethal and sublethal doses of x rays on spleen nucleotide levels in rats, mice, and guinea pigs; and the results of screening various chemical agents for prophylactic or therapeutic effects against radiation mortality in mice. (For preceding period see NP-4961.) (C.H.)

*2285

Atomic Energy Project, Univ. of Calif., Los Angeles

SOME FACTORS INFLUENCING THE METABOLISM OF RADIO-STRONTIUM BY ANIMALS. Warren J. Gross, Janice F. Taylor, and James C. Watson. Issued Jan. 6, 1954. 20p. Contract AT-04-1-GEN-12. (UCLA-274)

Ingested stable strontium is metabolized by rats in proportion to the concentration in the diet up to and including 100 times that found in the normal diet. Thus stable stontium does not influence the uptake of radiostrontium within the ranges studied. Under conditions of daily dosing with $Sr^{90} + Y^{90}$ the rate of deposition for Sr^{90} in rats declines with time. There is evidence to indicate that in growing rats a maximum level of retention for radiostrontium is attained as early as eleven weeks under conditions of persistent daily feeding with constant quantities of $Sr^{90} + Y^{90}$. Such a maximum level after once established apparently can be increased by increasing the daily dose and decreased by decreasing the daily dose. Attainment of a published value for maximum $Sr^{90} + Y^{90}$ body burden in man is discussed. (auth)

2286

Atomic Energy Project, Univ. of Rochester

PRENATAL MORTALITY RATES OF SEVENTEEN RADIATION INDUCED TRANSLOCATIONS IN MICE. Eileen M. Otis. Nov. 23, 1953. 60p. Contract W-7405-eng-49. (UR-291)

Seventeen chromosome translocations (semi-sterile lines) in the mouse were investigated to determine the prenatal mortality rates of lethally affected zygotes. Seven of the translocations were obtained from exposure to low chronic doses of radiation, and ten were obtained by single exposures to 600 r at 34.9 r/min and 48.5 r/min. Autopsies at successive days of gestation determined the daily change, expressed as per cent of corpora lutea, in live and dead embryos, placental remains, and preimplantation loss (corpora lutea not represented in the uterus). The mortality record was taken from the ninth day of gestation to that day on which the surviving embryos were about half of the survivors in normal pregnancies. Data are presented in tabular form and illustrated photographically. (auth)

2287

Atomic Energy Project, Univ. of Rochester

QUARTERLY TECHNICAL REPORT [FOR] OCTOBER 1 THRU DECEMBER 31, 1953. Feb. 9, 1954. 31p. Contract W-7401-eng-49. (UR-311)

Diisobutyl carbinol, capryl alcohol and a heavy-fraction alcohol with a molecular weight of about 185, as well as the phosphate esters of each, were found to have no toxic effects on rats or mice. Data are reported from preliminary studies of the relationship of radioactivity to particle size of fallout material. The use of an immunizing agent (Bacterin), a blood coagulant (Koagamin), and an acetylation antagonist (Antabuse), failed to alter the usual post-irradiation course, morbidity, and mortality of dogs. An antibiotic (Aureomycin) appeared to have some influence on the maintenance of

body weight of the irradiated animals. Data are included from studies of the toxicity of inhaled UO_2 fumes in rats. (For preceding period see UR-290.) (C.H.)

2288

Atomic Energy Project, Univ. of Rochester

ANOTHER POSSIBLE CAUSE OF SPONTANEOUS MUTATIONS. Robert L. Brent. Feb. 22, 1954. 24p. Contract W-7401-eng-49. (UR-313)

C^{14} is a naturally occurring radioactive isotope which produces 15.3 disintegrations/min per gram of biological carbon. Its transformation effect may be more potent in producing mutations than its radiating effect. Utilizing maximum assumptions, C^{14} can account for between 0.1% and 6% of the spontaneous mutations. This mutation rate is probably insignificant in accounting for germ cell mutations, but it may be responsible for a higher percentage of somatic mutations in more slowly growing body tissues. Furthermore, mutations which occur early in embryogenesis may be represented manifold in the adult. A review of the past ideas of the possible mutagenic effects of background radiation is presented. The author concurs with those in the past who think that the background radiation accounts for a significant proportion of spontaneous mutations in humans. Lastly, the effects of atomic transformation should be included in all estimates of the maximum permissible dose for radioactive isotopes able to be incorporated in the gene structure. (auth)

2289

Naval Radiological Defense Lab.

QUANTITATIVE SEROLOGICAL DETERMINATION OF ANTIBODY FORMATION IN X-IRRADIATED RABBITS. M. S. Silverman and P. H. Chin. Dec. 23, 1953. 18p. (USNRDL-422)

The effect of whole-body x irradiation on antibody formation in the rabbit was studied using the quantitative precipitin technique of Heidelberger and Kendall. The antigen, crystalline egg albumin, was administered together with Freund's adjuvant. A second group of animals immunized with alum-precipitated egg albumin was used to study the effect of whole-body x irradiation on the anamnestic reaction. It was found that even though the antigen was administered with adjuvant, which presumably permitted a prolonged, slow antigenic stimulation, the response of the animals receiving 400 r whole body x irradiation was lower than that of the non-irradiated animals. The amount of antibody nitrogen formed never equaled that of the non-irradiated animals even after 27 weeks, when recovery from radiation injury could be presumed to have occurred. However, a secondary rise in antibody nitrogen did occur in 3 out of 5 rabbits 14 to 23 weeks after immunization. Exposure to 400 r whole-body x irradiation 24 hr prior to the administration of a second injection of antigen was found to have no effect on the specific anamnestic reaction. (auth)

2290

INCORPORATION OF P^{32} INTO TRICHLOROACETIC ACID FRACTIONS OF LIVER FROM IRRADIATED AND NONIRRADIATED MICE. F. G. Sherman and A. Forssberg (Radiophysical Inst., Stockholm, Sweden). Arch. Biochem. and Biophys. 48, 293-9(1954) Feb.

The specific activity of orthophosphate, acid-labile phosphate, adenosine triphosphate (ATP), and total acid-soluble phosphate was determined in trichloroacetic acid extracts of liver and muscle from irradiated and nonirradiated mice at various times after irradiation. Immediately after irradiation the specific activity of ortho P and acid-labile P from the livers of irradiated mice was markedly increased. In both the 1-hr series and the 24-hr series the specific activity of these fractions had become much lower. Immediately after irradiation the specific activity of the ATP fraction was not increased as much as were the activities of the ortho P and acid-labile P fractions, but 24 hr after irradiation the specific activity of ATP became much higher than that of the controls. The specific activity of the total acid-soluble P was not appreciably different from that of the controls. In muscle, irradiation resulted in a depression of the specific activities of the compounds investigated. When excised liver was irradiated in Krebs-Ringer phosphate buffer the specific activities of ortho P, acid-labile P, ATP, and total-acid soluble P were almost exactly the same as they were for these compounds in the controls. (auth)

2291

THE IRRADIATION OF BACTERIAL SPORES WITH LOW-VOLTAGE ELECTRONS. Marguerite Davis (Yale Univ., New Haven, Conn.). Arch. Biochem. and Biophys. 48, 469-81(1954) Feb.

Three regions of radiation sensitivity are found in the spores of Bacillus subtilis. The first two form the spore wall, which is variable in thickness on each spore. The outer layer is completely inert, showing no reaction to radiation; this might correspond to a dried slime layer which is said to surround the spore. An inner spore wall lies within this completely inert layer which shows low sensitivity to ionizing radiation, the effect being cumulative. The total thickness of the two spore coats is less than 350 A. The portion of the spore most sensitive to radiation is organized into units of large molecular weight which are dispersed at random throughout the interior of the spore. No evidence of a single organized nucleus containing the particles of maximum radiation sensitivity is found by this method of investigation. (auth)

2292

EFFECT OF TOTAL BODY X-IRRADIATION ON THE TRYPTOPHAN PEROXIDASE ACTIVITY OF RAT LIVER. Proc. Soc. Exptl. Biol. Med. 85, 29-32(1954) Jan.

Total-body x irradiation produces within a few hours a dose-dependent increase in the tryptophan peroxidase-oxidase system of rat liver. The increase does not occur in adrenalectomized rats, and hence cannot be construed as a direct effect of x irradiation. (auth)

2293

SUBLETHAL TOTAL BODY IRRADIATION AND I^{131} METABOLISM IN THE RAT THYROID. Robert A. Monroe, John H. Rust, and Bernard F. Trum (Univ. of Tenn.–Atomic Energy Commission Agricultural Research Program, Oak Ridge). Science 119, 65-7(1954) Jan. 8.

Comparative values are presented for the uptake and binding of I^{131} by the thyroid of rats at various intervals following exposure to 665 r of γ or 500 r of x radiation. In one day the thyroids of rats receiving Co^{60} irradiation accumulated about twice as much as the controls, and the thyroids of the x-irradiated rats showed a fourfold increase over the controls. The I^{131} in the protein-bound and thyroxine fractions increased concomitantly with the total I^{131} in both groups of irradiated rats. Results are consistent with the concept that the stimulus to the thyroid is indirect and not caused by the radiations per se. Comparison is made with observations on the excited thyroids of irradiated burros. (C.H.)

2294

DEPIGMENTATION OF HAIR AS A BIOLOGICAL RADIATION DOSIMETER. Jack Moshman and Arthur C. Upton (Oak Ridge Natl. Lab., Tennessee). Science 119, 186-7 (1954) Feb. 5.

The examination of large numbers of mice exposed to graded doses of whole-body ionizing radiation led to the conclusion that the degree of depigmentation of fur of mice is correlated closely enough with the dose of radiation to

constitute a convenient biological dosimeter. The correlation was found to vary markedly with different regions of the coat, and for the mice studied, it was more constant for the fur of the top of the head for that of other areas examined. (C.H.)

2295

SKIN REACTION TO PROTRACTED BETA IRRADIATION. H. D. Griffith, J. F. Philip, and G. E. Swindell (Aberdeen Royal Infirmary, Scotland). Brit. J. Radiol. 27, 107-12 (1954) Feb.

Comparison is made of skin reactions consequent upon handling glass-screened radioactive material with the dose of β radiation received, protraction being up to four years. The results are considered in relation to some other cases reported in the literature and as assessment is made of the numerical factor by which exposure to β radiation must exceed exposure to x radiation for induction of similar skin changes. (auth)

2296

THE CHEMISTRY OF BIOLOGICAL AFTER-EFFECTS OF ULTRAVIOLET AND IONIZING RADIATIONS. (A SYMPOSIUM). X. MODIFICATION OF RADIATION DAMAGE AFTER EXPOSURE TO X RAYS. Alexander Hollaender and George E. Stapleton (Oak Ridge National Lab., Tennessee). Brit. J. Radiol. 27, 117-121(1954) Feb.

Studies of the effects of temperature and of the presence in the growth media of certain nutrient substances on the recovery of E. coli from the effects of x irradiation are reported. Data are summarized from a number of studies demonstrating modifications produced on the x-ray sensitivity of E. coli, Drosophila, and other tissues, by removal of O, by chemicals, by reduction of temperature, and by various treatments after x-ray exposure. Data are included from studies of photo- and heat-reactivation of E. coli after exposure to ultraviolet radiation. Possible mechanisms of radiation protection are discussed briefly. (C.H.)

2297

THE CHEMISTRY OF BIOLOGICAL AFTER-EFFECTS OF ULTRAVIOLET AND IONIZING RADIATIONS. (A SYMPOSIUM). XI. AFTER-EFFECTS OF RADIATION AND CHEMICALS ON CHROMOSOMES AND GENES. C. Auerbach (The University, Edinburgh, Scotland). Brit. J. Radiol. 27, 122-4(1954) Feb.

After-effects of nuclear changes in chromosomes and genes produced by exposure to ionizing radiations, ultraviolet radiation, and chemical and physical mutagens are discussed. Modification of the effects of various mutagens by various post-treatments are reviewed, and an attempt is made to explain some of the mechanisms of mutation. (C.H.)

2298

THE CHEMISTRY OF BIOLOGICAL AFTER-EFFECTS OF ULTRAVIOLET AND IONIZING RADIATIONS. (A SYMPOSIUM). XII. DELAYED EFFECTS IN CHROMOSOME BREAKAGE BY X RAYS. K. C. Bora (Cambridge Univ., England). Brit. J. Radiol. 27, 124-7(1954) Feb.

Theories of the nature of delayed radioinduced chromosome breakage are reviewed. (C.H.)

2299

THE CHEMISTRY OF BIOLOGICAL AFTER-EFFECTS OF ULTRAVIOLET AND IONIZING RADIATIONS. (A SYMPOSIUM). XIII. THE OXIDATIVE PHOSPHORYLATION BY MITOCHONDRIA ISOLATED FROM THE SPLEEN OF RATS AFTER TOTAL BODY EXPOSURE TO X RAYS. D. W. van Bekkum, H. J. Jongepier, H. T. M. Nieuwerkerk, and J. A. Cohen. Brit. J. Radiol. 27, 127-30(1954) Feb.

The oxidative phosphorylation of isolated rat spleen mitochondria has been measured following a total-body x irradiation of 1100 r. Four hours after irradiation, the phosphorylation, O uptake, and P/O ratio are significantly reduced. This effect has been observed with succinate as well as with α-ketoglutarate as a substrate. (auth)

2300

THE CHEMISTRY OF BIOLOGICAL AFTER-EFFECTS OF ULTRAVIOLET AND IONIZING RADIATIONS. (A SYMPOSIUM). XIV. RADIATION PROTECTIVE COMPOUNDS: A COMPARISON OF THEIR EFFECTS IN IN VIVO AND IN VITRO SYSTEMS. P. Alexander, M. Fox, and S. F. Hitch (The Royal Cancer Hospital, London, and Imperial Coll. of Science, London). Brit. J. Radiol. 27, 130-1(1954) Feb.

In vivo and in vitro methods for evaluating the protective effects of various compounds against radiation injuries are discussed. Results are summarized from comparative experiments using the two systems, mouse and polymer. Possible mechanisms in radiation protection are discussed briefly. (C.H.)

2301

THE CHEMISTRY OF BIOLOGICAL AFTER-EFFECTS OF ULTRAVIOLET AND IONIZING RADIATIONS. (A SYMPOSIUM). XV. FREE RADICAL PRODUCTION IN OXIDATION-REDUCTION REACTIONS OF PEROXIDASE, CATALASE AND METMYOGLOBIN. Philip George and D. H. Irvine (Cambridge Univ., England). Brit. J. Radiol. 27, 131-7(1954) Feb.

Possible mechanisms of action of ionizing radiations on biological systems are discussed. The after effects of ionizing radiations on aqueous systems, and the effects of free radical intermediates on biological oxidation and reduction reactions are reviewed. Topics discussed include the role of the catalases, peroxidases, and metmyoglobin in oxidation, and their role in determining the mechanisms of the biological effects of ionizing radiations; the formation of intermediate compounds by metmyoglobin, peroxidase, and catalase in the presence of peroxides; the enzyme-substrate complex theory of peroxidase and catalase action; intermediate compounds in the oxidation of hemoproteins; stepwise mechanisms of peroxidase action involving free radical formation; radical production in the reaction of metmyoglobin with peroxides; and thermochemical data bearing on the reactivity of hemoproteins with HO, H_2O_2, O_2H^-, H_2O, O_2^-, and O_2. (C.H.)

2302

THE CHEMISTRY OF BIOLOGICAL AFTER-EFFECTS OF ULTRAVIOLET AND IONIZING RADIATIONS. (A SYMPOSIUM). XVI. ACTION OF X RAYS ON THE GLUTATHIONE 1:4-NAPHTHOQUINONE REACTION. E. Friedmann (Cambridge Univ., England). Brit. J. Radiol. 27, 137-44(1954) Feb.

Medium doses of x rays cause degradation of 1,4-naphthoquinone, of the initial and of the intermediate 1,4-naphthoquinone-glutathione products, and of the final adduct S-(1,4-naphthoquinolyl-2)glutathione. The degree of degradation increases by increasing the dose of the irradiation applied. After irradiation of the initial products at 4×10^{-6}M with 10,000 r only a small amount of 1,4-naphthoquinone escapes degradation. No $-$SH or $-$SS compounds could be detected amongst the products of irradiation under the conditions described. Irradiation of 1000 r and lower doses applied to glutathione-1,4-naphthoquinone cause little or no degradation. Instead of degradation increased interaction is found. This increase is only observed at the beginning. After 2 hr the rate of interaction becomes gradually smaller and after 5 hr irradiated and non-irradiated reaction mixtures give the same absorption spectrum. Thus the effects of those irradiations can appear as acceleration or as inhibition of interaction according to the time after irradiation they are examined. A ratio between applied x-ray dose and concentration of the reactants, resulting in interaction, has been found in two cases. The most suitable dose for causing as-

sociation for the concentration of 10^{-5}M of the reactants is 1000 r; for 10^{-6}M 100 r to 200 r is equally effective. The graphs obtained in these two sets of experiments are almost identical. (auth)

2303

THE EFFECT OF RADIATION DOSE FRACTIONATION ON CHROMOSOME ABERRATION FREQUENCIES IN TRADESCANTIA MICROSPORES. II. STUDIES WITH FAST NEUTRONS. Norman H. Giles (Yale Univ., New Haven, Conn.), Frederick J. De Serres (Oak Ridge National Lab., Tennessee) and Alvin V. Beatty (Emory Univ., Atlanta, Ga.). Genetics 38, 416-20(1953) July

Experiments have been performed with fast neutrons to test the effect of dose fractionation on the frequencies of chromosome aberrations induced in Tradescantia microspores. A single dose of 25 n was administered without fractionation, and in two equal fractions with intervals of 1, 2, 4, 8, and 12 hr between fractions. No effect of fractionation has been found, and the frequencies of both types of aberrations studied were essentially the same for all treatments. Further, aberration frequencies obtained from a single dose of 12.5 n were approximately half those produced by 25 n. These results are in marked contrast to those obtained in similar comparative experiments with x rays where a pronounced decrease in aberration frequencies, with no recovery even with intervals between fractions as long as 12 hr, results from dose fractionation. The data obtained in the present experiments with fast neutrons are in agreement with previous hypotheses as to the mechanisms by which radiation-induced chromosome aberrations arise in Tradescantia. They do not support the contention that there exists an inhibition-recovery sequence in the production by radiation of chromosome breakage. (auth)

2304

COMPARATIVE EFFECTS OF COBALT 60 AND RADIUM WHEN UTILIZED IN IDENTICAL DOSES ON THE SKIN OF RABBITS. Isadore Meschan and Anderson Nettleship (Univ. of Arkansas, Little Rock). Am. J. Roentgenol. Radium Therapy Nuclear Med. 71, 306-19(1954) Feb.

Gross and microscopic comparisons were made at one- to 4-week intervals of the radiation effects on rabbit skin of externally applied Ra^{226} and Co^{60} plaques of identical doses. Identical reactions were obtained in every respect in 30 of the 58 rabbits of the gross series. In 27 rabbits the Co^{60} reaction was slightly or moderately more severe, and in one rabbit the Ra^{226} reaction was more severe. In the microscopic studies, slight differences were noted pointing toward an earlier hyperplastic and greater ulcerative reaction due to Co^{60}. Details of experimental methods, dosage calculations, and results are included. (C.H.)

2305

THE EFFECT OF X IRRADIATION AND LOWERED METABOLIC RATE ON THE MORPHOGENESIS OF DEVELOPING MELANOPLUS DIFFERENTIALIS EMBRYOS. Theodore N. Tahmisian, Janet V. Passonneau, and Dorothy M. Adamson. (Argonne National Lab., Lemont, Ill.). J. Natl. Cancer Inst. 14, 941-53(1954) Feb.

The extent of x-ray injury in developing grasshopper embryos was determined by cytologic, morphologic, and physiologic examination. At an optimum dose of x radiation the capacity of the cells to maintain organization was abolished, and they underwent regression in size. Under anaerobic conditions ten times the x-ray dose was required to elicit the same degree of damage observed aerobically, while the caloric output under aerobic conditions was about 300 times that measured anaerobically. The sequence of biological susceptibility to x irradiation is: tissue differentiation > cell division > anabolism > catabolism. (auth)

2306

WEIGHT RESPONSE OF IRRADIATED ACCESSORY SEX ORGANS OF THE CASTRATE MALE RAT TO TESTOSTERONE PROPIONATE. Walter Fleischmann and John T. Brackin, Jr. (Veterans Administration Hospital, Oteen, N. C. and Abington Memorial Hospital, Abington, Penna.). Endocrinology 54, 227-8(1954) Feb.

Under the conditions of the experiments outlined, the growth induced by testosterone pripionate in the accessory sex organs of castrated male rats is only partially inhibited by x irradiation. This preparation offers a good opportunity for the study of the effect of x rays on growth of tissues due to a specific stimulation of growth. (auth)

RADIATION HAZARDS AND PROTECTION

*2307

Brookhaven National Lab.

HEALTH PHYSICS PROGRAM FOR THE BROOKHAVEN COSMOTRON. F. P. Cowan and J. S. Handloser. Nov. 1953. 35p. (BNL-264)

A summary is presented of radiation safety procedures in effect at the Brookhaven Cosmotron. The machine is described briefly, and the effects of the pulsed mixed radiation on measurements is discussed. Instruments used in measuring radiations and tissue equivalent and depth-dose measurements are described, survey results are tabulated, the present policy in regard to exposure is outlined, and personnel monitoring procedures now in effect are described. (C.H.)

2308

Naval Radiological Defense Lab.

STUDIES ON THE TREATMENT OF INTERNAL RADIOACTIVE CONTAMINATION. 4. EFFECT OF ZIRCONIUM CITRATE AND EDTA ON THE DISTRIBUTION AND EXCRETION OF A MIXTURE OF LONG-LIVED FISSION PRODUCTS. J. K. Gong, W. L. Milne, and S. H. Cohn. Dec. 24, 1953. 16p. (USNRDL-426)

The effects of zirconium citrate and sodium EDTA on the distribution and excretion of an injected mixture of long-lived fission products was investigated. The mixture contained the fission products which present the most serious health hazard, from the chronic internal irradiation viewpoint. It was found that zirconium citrate administered before the fission products afforded the most effective prevention of their deposition in the skeleton. Zirconium citrate, however, was of no effect as a decontaminating agent when administered as late as 3 days after the injection of the mixture of fission products. The administration of EDTA prior to the injection of fission products resulted in a slightly decreased skeletal concentration of the fission products and a significant increase in their excretion. It was noted that the administration of sodium citrate resulted in no effect on the distribution or excretion of the injected fission product mixture. The combined use of EDTA and zirconium citrate offered no enhanced internal skeletal tissue decontamination over that obtained following the administration of zirconium citrate alone.

2309

MODIFICATION OF LETHAL IRRADIATION INJURY IN MICE BY INJECTION OF HOMOLOGOUS OR HETEROLOGOUS BONE. Egon Lorenz and Charles C. Congdon (National Cancer Inst., Bethesda, Md., and Argonne National Lab., Lemont, Ill.). J. Natl. Cancer Inst. 14, 955-61(1954) Feb.

Bone of mouse and rat when transplanted intraperitoneally protects LAF_1 mice from a lethal dose of x radiation. Homologous bone induced bone-marrow formation in the transplant; it is postulated that this bone marrow originates from the osseous tissue. Heterologous rat bone protects LAF_1 mice also but bone-marrow formation did not occur in the transplant.

The experiments give further evidence for the existence of a humoral factor or factors in postirradiation protection. (auth)

2310

PROTECTION OF IRRADIATED RATS BY PARABIOSIS WITH ADRENALECTOMIZED OR SPLENECTOMIZED PARTNERS. Martin Schneider, Robert C. Wybourn, Robert Binhammer, and John C. Finerty (Univ. of Texas Medical Branch, Galveston). Radiology 62, 234-40(1954) Feb.

The protective effect of parabiosis upon irradiated rats was shown in this experiment. Three groups of animals were described in which one member of a littermate pair had previously received an LD_{96} 30-day dose of x radiation. One group of 31 pairs consisted of irradiated-normal parabionts in which survival at thirty days was shown to be 81 per cent. A second group of irradiated-adrenalectomized pairs showed a survival of 59 per cent after the same length of time. Irradiated-splenectomized pairs made up a third group, with a survival rate of 68 per cent. Separation of all of the pairs was done thirty days after exposure to x rays and all but 5 irradiated animals survived an additional thirty days. It is concluded that post-irradiation parabiosis permanently protects a great majority of irradiated rats from the lethal effects of irradiation. Since neither adrenalectomy nor splenectomy of the non-irradiated partner significantly changed the degree of protection, it is further concluded that the spleen is necessary in the non-irradiated partner for permanent protection from irradiation by parabiosis. (auth)

RADIOTHERAPY

2311

TEN YEARS' EXPERIENCE WITH RADIOACTIVE IODIDE. Earle M. Chapman, Farahe Maloof, Jorge Maisterrena, and Jorge M. Martin (Massachusetts General Hospital, Boston). J. Clin. Endocrinol. and Metabolism 14, 45-55(1954) Jan.

Data are presented on the 1953 follow-up of 45 patients with hyperthyroidism treated with I^{131} between 1943 and 1946. Clinical experiences with I^{131} extending over a ten-year period are summarized. (C.H.)

2312

THE SASKATCHEWAN 1,000-CURIE COBALT 60 UNIT. T. A. Watson, H. E. Johns, and C. C. Burkell, (Saskatoon Cancer Clinic, Saskatchewan, Canada). Radiology 62, 165-76(1954) Feb.

Some comparisons of the physical properties of cobalt 60 radiation with that produced at 200 kv, 3 Mev, and 25 Mev are made. It is shown that cobalt 60 radiation and 3-Mev x rays are similar from the point of view of therapeutic application. When one considers integral dose, surface dose, depth dose, differential absorption of bone and cartilage, the advantages of a high-energy source, such as cobalt 60, are obvious. Some of the practical advantages in the clinical use of a cobalt unit are discussed. The unit is simple, precise, mobile, and trouble-free in operation. (auth)

TRACER APPLICATIONS

2313

Brookhaven National Lab.

THE MECHANISM OF PENTOSE PHOSPHATE CONVERSION TO HEXOSE MONOPHOSPHATE. 2. WITH PEA LEAF AND PEA ROOT PREPARATIONS. M. Gibbs and B. L. Horecker. Brookhaven National Lab. and National Inst. of Arthritis and Metabolic Diseases, National Institutes of Health. [1953] 25p. (BNL-1704)

2314

Brookhaven National Lab.

THE USE OF POLARIZED LIGHT IN THE PHOTOGRAPHY OF UNSTAINED HISTOLOGICAL RADIOAUTOGRAPHS OF PLANT TISSUES Robert F. Smith. [1953?] 3p. (BNL-1705)

2315

Brookhaven National Lab.

POSITION OF C^{14} IN ALCOHOL AND CARBON DIOXIDE FORMED FROM LABELED GLUCOSE BY CORN ROOT TIPS. Harry Beevers and M. Gibbs. Purdue Univ. and Brookhaven National Lab. [1953] 16p. (BNL-1708)

2316

Brookhaven National Lab.

THE DIRECT OXIDATION PATHWAY IN PLANT RESPIRATION. Harry Beevers and Martin Gibbs. [1953] 12p. (BNL-1724)

Experiments have been carried out on a variety of plant tissues to find whether the oxidative pathway of glucose breakdown ("hexosemonophosphate shunt") contributes to their respiration. When initial yields of $C^{14}O_2$ from equal amounts of glucose-1-C^{14} and glucose-6-C^{14} were compared there was clear evidence that, in most of the tissues, some of the glucose was, in fact, broken down in reactions in which C-1 was split off at an earlier stage than C-6. It has been calculated from the data that in several of the tissues a maximum of about half of the glucose was broken down by the E.M.P. pathway. The fact that the initial yields of $C^{14}O_2$ from the two kinds of glucose were the same when corn root tips were used confirms an earlier finding that in this juvenile tissue the classical glycolytic route is the sole one; in the other tissues it is concluded that a substantial fraction of the glucose is respired via the direct oxidation pathway. (auth)

2317

Brookhaven National Lab.

THE DETECTION OF THYROID STIMULATING HORMONE BY I^{131} UPTAKE IN CHICKS. C. J. Shellabarger. [1954] 13p. (BNL-1726)

A method for the detection and assay of TSH has been described using the day-old White Leghorn cockerel. The material to be assayed is injected in 5 equal doses at 12-hr intervals. I^{131} is administered 12 hr later and I^{131} uptake by the thryoid gland is determined 5 hr after isotope administration. (auth)

*2318

Atomic Energy Project, Univ. of Calif., Los Angeles

FIXATION AND EXTRACTABILITY OF FISSION PRODUCTS CONTAMINATING VARIOUS SOILS AND CLAYS: I. Sr^{89}, Sr^{90}, Y^{91}, Ru^{106}, Cs^{137}, and Ce^{144}. Hideo Nishita, Bruce W. Kowalewsky and Kermit H. Larson. Feb. 23, 1954. 32p. Contract AT-04-1-GEN-12. (UCLA-282)

Water-soluble, exchangeable and non-exchangeable forms of long- and medium-lived fission products (Sr^{89}, Sr^{90}, Y^{91}, Ru^{106}, Cs^{137}, and Ce^{144}) contaminating 8 soils and 2 clay minerals were investigated by using chemical and plant uptake methods. With few exceptions, the general relationships between these fission products and soils were: for the water soluble fraction, $Ru^{106} \gg Sr^{89} > Sr^{90} > Y^{91} > Ce^{144} > Cs^{137}$; for the exchangeable fraction, $Sr^{89} > Sr^{90} > Cs^{137} \gg Ru^{106} > Y^{91} > Ce^{144}$; for the non-exchangeable fraction, $Ce^{144} > Y^{91} > Ru^{106} > Cs^{137} > Sr^{90} > Sr^{89}$. Exceptions are discussed on the basis of soil pH, chemical properties of isotopes, and clay mineral type. The order of uptake of these fission products by barley plants was $Sr^{90} > Cs^{137} > Y^{91}$, Ru^{106}, Ce^{144}. A relatively large amount of Sr^{90} was absorbed and translocated to plant tops. The uptake of Y^{91}, Ru^{106}, and Ce^{144} was very small, and in most cases, their translocation to plant tops was insignificant at the 5% probability level. The kind of clay mineral and the kind of adsorbed ion influenced fixation of isotopes. The extractability of Y^{91} and of Ce^{144} followed their respective hydrolysis curves. (auth)

2319
Atomic Energy Project, Univ. of Rochester
THE RECRYSTALLIZATION OF BONE MINERAL. W. F. Neuman and J. H. Weikel, Jr. Feb. 22, 1954. 24p. Contract W-7401-eng-49. (UR-314)

Results are reported from an investigation of the mechanism of the recrystallization process in bone and determinations of the fraction of the bone entering into the recrystallization process. Adult rats were placed on a diet containing radioactive Ca of constant specific activity, and analyses of bones at varying time intervals were made to determine the fraction of the bone turned over. A kinetic study of a synthetic system in vitro was made to resolve the mechanism of the reaction. A schematic sketch is included of the apparatus used in the kinetic study of the exchange process, and results are presented graphically. (C.H.)

2320
AN IMPROVED TECHNIC FOR LIQUID EMULSION AUTORADIOGRAPHY. James S. Arnold (Argonne National Lab., Lemont, Ill.). Proc. Soc. Exptl. Biol. Med. 85, 113-16(1954) Jan.

A method for the preparation of autoradiographs with thin liquid coated emulsion layers has been described. (auth)

CHEMISTRY

2321
Brookhaven National Lab.
KINETICS OF THE EXCHANGE OF HYDROGEN BETWEEN PHOSPHINE AND WATER: A KINETIC ESTIMATE OF THE ACID AND BASE STRENGTHS OF PHOSPHINE. Ralph E. Weston, Jr. and Jacob Bigeleisen. [1953] 31p. (BNL-1655)

The rate of approach to equilibrium in the H exchange between phosphine and water containing 3% D has been measured by following the uptake of D in the phosphine. Under conditions where the diffusion from the gaseous to the liquid phase is not rate-determining, the fraction of exchange as a function of time follows the usual McKay rate law. The rate expression may be written as

$$d(PH_2D)/dt = (PH_3)\{\Sigma_i k_{HA_i}(HA_i) + k_{OH^-}(OH^-)\}$$

where HA_i represents a general acid with exchangeable proton. By making reasonable assumptions concerning rate constants, an estimate of 10^{-28} is made for the base dissociation constant of phosphine in water. A similar estimate of 10^{-29} is made for the acid dissociation constant. (auth)

2322
Brookhaven National Lab.
AN LCAO-MO STUDY OF THE THERMOCHROMISM OF BIANTHRONE. Sheldon L. Matlow. [1953] 6p. (BNL-1720)

2323
Callery Chemical Co.
VAPOR PRESSURE CORRELATION FOR ALKYL DIBORANE AND TRIALKYL BORINES. W. J. Cooper and P. A. Joyner. Mar. 9, 1954. 8p. (CCC-1024-TR-12)

A literature search showed that a limited amount of vapor pressure data was available on alkyl diboranes and trialkyl borines. By correlating the available data by the methods of Cox and Colingaert, estimated vapor pressure equations were obtained. Plots of these derived equations are given. (auth)

2324
Pittsburgh Univ.
STRUCTURE AND BEHAVIOR OF ORGANIC ANALYTICAL REAGENTS. 7. STABILITY OF CHELATES OF 2-(o-HYDROXYPHENYL)BENZIMIDAZOLE AND ANALOGOUS REAGENTS. W. D. Johnston and H. Freiser. [1953] 12p. [Contract AT(30-1)-860]. (NYO-3776)

2325
Syracuse Univ.
PHOTOCHEMICAL REACTIONS OF COMPLEX MOLECULES IN CONDENSED PHASE. Henry Linschitz. Consists of three papers: THE IDENTIFICATION OF SOLVATED ELECTRONS AND RADICALS IN RIGID SOLUTIONS OF PHOTO-OXIDIZED ORGANIC MOLECULES; RECOMBINATION LUMINESCENCE IN ORGANIC PHOSPHORS. Henry Linschitz, Myron G. Berry, and Donald Schweitzer. 26p.; SYMMETRICAL SEMIQUINONE FORMATION BY REVERSIBLE PHOTOXIDATION AND PHOTOREDUCTION. Henry Linschitz, Joseph Rennert, and T. Marc Korn. 13p.; and KINETICS OF PORPHYRIN-CATALYSED CHEMILUMINESCENT DECOMPOSITION OF PEROXIDES, AND THE MECHANISM OF PHOTOSENSITIZED OXIDATION. Henry Linschitz and Edwin W. Abrahamson. 5p. Dec. 1, 1953. Contracts AT(30-1)-820 and DA-36-039-sc-15533. (NYO-6276)

Rigid solutions of alkali metals in solvents containing methylamine show an absorption peak at 6,000 A. Upon illumination, a new band appears in the near infrared, and the 6,000-A peak diminishes, which is attributed to incompletely solvated electrons. The infrared band is also found in illuminated rigid solutions of easily oxidized organic molecules, indicating that photoejection of electrons has occurred. Delayed luminescence frequently occurs from solutions of such organic molecules upon slight softening of the solvent, which can be maintained for hours if the solvent viscosity is properly controlled. Evidence is presented which establishes that the luminescence is due to triplet states arising from recombination of radicals and trapped or solvated electrons, both formed originally by photo-oxidation of the parent molecule. In rigid solvents, the illumination of either diphenyl-p-phenylenediamine or the corresponding imine yields a new substance having a characteristic absorption band at 7100 A. It is shown that this compound is the semiquinone of the imine-amine redox couple. Thus, both photo-oxidation and the inverse process of photoreduction may occur, leading to the same semiquinone. Similar behavior is demonstrated for the hydroquinone–benzoquinone couple. An investigation of the kinetics of the chemiluminescent reaction between certain dyes and organic peroxides is reported. The reaction between Zn tetraphenylporphine and tetralin hydroperoxide was studied at 149°C in tert-butylbenzene solvent. Typical results are given showing the catalytic effect of the porphyrin on the peroxide decomposition and data on the luminescence. (J.A.G.)

*2326
Oak Ridge National Lab.
ALKALI METAL-NICKEL OXIDES CONTAINING TRIVALENT NICKEL. [PERIOD COVERED] JANUARY 1952–JULY 1953. L. D. Dyer, B. S. Borie, Jr., and G. P. Smith. Mar. 15, 1954. 14p. Contract W-7405-eng-26. (ORNL-1667)

This article describes the preparation and the properties of two compounds of trivalent nickel which had not previously been isolated. These substances occur as the products of the corrosion of nickel by fused alkali metal hydroxides under oxidizing conditions. The compounds $NaNiO_2$ and $LiNiO_2$ were prepared by bubbling oxygen through sodium hydroxide and lithium hydroxide, respectively, contained in

nickel tubes at about 800°C. The crystals obtained upon removing the top section of the cooled melt were washed with absolute ethyl alcohol to remove the hydroxide. The sodium compound was also prepared by heating a 1:3 mixture of sodium peroxide and sodium hydroxide in a nickel tube and treating as described above. Lithium nickelate(III) is rhombohedral, and its structure is the same as that of cesium dichloriodide. The unit cell dimensions, referred to hexagonal axes, are a = 2.88A and c = 14.2A. The hexagonal cell contains three formula weights, and the calculated density is 4.78 g/cm^3 (measured 4.81 g/cm^3). Two crystal modifications were found for $NaNiO_2$, and the transformation temperature was about 220°C. The low-temperature crystal form is a monoclinic distortion of the $LiNiO_2$ structure. The unit cell dimensions are a = 5.33A, b = 2.86A, c = 5.59A, and $\beta = 110° 30'$. There are two formula weights per unit cell, and the calculated density is 4.74 g/cm^3 (measured 4.72 g/cm^3). The high-temperature crystal form is isomorphous with $LiNiO_2$. The unit cell dimensions, referred to hexagonal axes, are a = 2.96A and c = 15.77A. The reactions of sodium nickelate(III) and lithium nickelate(III) with alkaline solutions, with water, and with various acids were investigated and the results are reported. (auth)

*2327

Oak Ridge National Lab.

SOME PROPERTIES OF HAFNIUM OXIDE, HAFNIUM SILICATE, CALCIUM HAFNATE AND HAFNIUM CARBIDE. C. E. Curtis, L. M. Doney, and J. R. Johnson. Mar. 15, 1954. 36p. Contract No. W-7405-eng-26. (ORNL-1681)

The behavior of hafnium oxide was studied, particularly in the temperature range from 1500 to 1800°C. Properties of HfO_2 at these temperatures and its reactions with ZrO_2, SiO_2, and CaO are given in terms of lattice and other physical measurements, many of which are new. Monoclinic hafnium oxide is stable to 1700°C, which is 600° higher than the corresponding inversion temperature of zirconia. Otherwise HfO_2 closely resembles ZrO_2 in its lattice dimensions and sintering behavior, in forming a high-temperature tetragonal phase closely resembling tetragonal ZrO_2, in forming a continuous series of solid solutions with ZrO_2, in forming with silica a single compound (HfO_2-SiO_2) similar to zircon, in forming a carbide, in uniting with up to 40% CaO to form cubic solid solutions; thereafter a compound $CaO{\cdot}HfO_2$ appears which is very similar to the corresponding zirconia compound. (auth)

2328

Institute of Science and Tech., Univ. of Ark.

RECRYSTALLIZATION OF ALUMINUM OXIDE. TERMINAL REPORT. [W. J. Smothers]. Dec. 31, 1953. 30p. Contract AT-(40-1)-1344. (ORO-108)

The sintering and grain growth of alumina as a function of the type of impurity (oxide) added was studied. One weight per cent of the impurity was added to a commercial, fine-grained alumina or was coprecipitated with $AlCl_3$ to form hydroxides. Fired shrinkage, bulk density, and apparent porosity measurements were used to correlate sintering with grain growth as observed by the petrographic and electron microscope. Some additives which increased grain growth were believed to enter into solid solution with alumina and to strain the lattice sufficiently to increase material transport greatly. Other additives were believed to produce a glassy phase which would greatly increase surface diffusion and resulting grain growth. Some additives decreased grain growth because of the relatively large vapor phase produced by the impurity upon heating which may have been sorbed on the alumina, while other additives may have filled anion vacancies to reduce material transport or may have produced complex anions whose flow or diffusion may be impeded. (auth)

*2329

Radiation Lab., Univ. of Calif., Berkeley

ZIRCONIUM THENOYLTRIFLUOROACETONATE: SOLUBILITY AND EXTRACTION. E. H. Huffman and G. M. Iddings. June 17, 1949. Decl. Nov. 16, 1953. 10p. Contract W-7405-eng-48. (UCRL-377)

Solubilities of zirconium thenoyltrifluoroacetonate have been determined in anhydrous benzene at 20, 30, and 40°C, in 0.01, 0.02, 0.04, and 0.08 molar thenoyltrifluoroacetone in benzene at 20°C, in benzene saturated with water at 20°C, and in 0.02 molar thenoyltrifluoroacetone in benzene in contact with 2 molar perchloric acid at 20°C. (auth)

2330

POLAROGRAPHIC STUDIES OF COMPLEXES IN AQUEOUS SOLUTIONS. M. von Stackelberg and H. von Freyhold. Translated from Z. Elektrochem. 46, 120-9(1940). 25p. (AEC-tr-82)

The theory of the influence of a complex formation on the reversible reduction or oxidation of a substance at a dropping electrode is given. The determination of the composition and dissociation constants of complexes in solution from polarograms is subject to several limitations. (1) The attainment of equilibrium at the drop surface must take place in a fraction of a second. (2) It is often possible to determine only ratios of the complexity constants even with completely reversible polarographic waves. (3) The rather low order of accuracy on the determination of the complexity constants and the restriction that the complexing agent concentration cannot be too small was shown by the work with copper ammonia complexes. The copper waves in chloride solutions were studied in detail since the transition of a single Cu II/Cu wave to a double Cu II/Cu I—Cu I/Cu wave could be followed. A quantitative explanation was given in the case where, for Cl^- concentrations of 0.01 to 1N, the complex $CuCl_2^-$ was assumed for Cu I while there was no noticeable complex formation of Cu II. (auth)

2331

ON THE QUESTION OF CHEMICAL PRIMING OF THERMONUCLEAR REACTIONS. Eugen Sänger. Translated from Z. Naturforsch. 6a, 302-4(1951). 4p. (AEC-tr-1625; AERE-Trans-11/3/5/355)

The ignition temperatures of thermonuclear reactions are 10^7 to 10^{10} times higher than those of ordinary chemical combustion reactions and are 5 to 8 orders of magnitude above the highest chemical reaction temperatures. Theoretically, the temperature at the center of converging compression waves in gases rises to infinity. In recent investigations on the nature of the detonation of solid and liquid explosives, detonation and compression waves preceding the chemical reaction have been observed in the vaporized explosive by means of luminescence radiation. With the aid of such convergent detonation waves one may thus raise the temperature of a finite fraction of the chemically reacting explosive mass to the vicinity of the thermonuclear reaction ignition temperatures. The limit to this kinetic temperature rise is set by the temperature of complete ionization and in mixtures of explosive smoke of the highest total ionization temperature a critical approach appears to be made to the lowest of thermonuclear reaction ignition temperatures. (auth)

2332

PRODUCTS OF THE THERMIC DEHYDRATION OF $Na_6P_3O_{10}{\cdot}6H_2O$ AND THE PROBABLE FORMATION OF A DIMETAPHOSPHATE. Erich Thilo and Hans Seemann. Translated by I. Albert Warheit from Z. anorg. u. allgem. Chem. 267, 65-75(1951). 18p. (AEC-tr-1788)

By analytical and roentgenological methods and by

density and molecular weight determinations in molten Glauber salt it is shown that in dehydrating $Na_5P_3O_{10}\cdot 6H_2O$ with simultaneous hydrolysis of the anion there is first formed $Na_4P_2O_7$ and NaH_2PO_4, which in a secondary reaction at a higher temperature is converted to the dehydrated triphosphate $Na_5P_3O_{10}$. In contrast to the references in the literature no dimetaphosphate is formed. The reasons for this former erroneous assumption are explained. (auth)

2333

ELECTROMOTIVE FORCE OF FUSED SALT CONCENTRATION CELLS. S. A. Pletenev [Plemenev] and V. N. Rozov. Translated from Zhur. Fiz. Khim. 9, 854-66(1937). 20p. (AEC-tr-1818)

The magnitude of the emf concentration cells containing AgCl, $PbCl_2$, $CdCl_2$, and $ZnCl_2$ in fused eutectics of the chlorides of the alkali and alkaline earth metals was measured. The emf is linearly dependent on the log of the mole fraction of the investigated metal in the melt. The character of the linear dependence varies when there is an absence of chemical combination between the salt of the metal investigated and the eutectic melt. (J.S.R.)

2334

NEW THERMAL CONDUCTIVITY MEASUREMENTS OF ORGANIC LIQUIDS. L. Riedel. Translated from Chem.-Ing.-Tech. 23, 321-4(1951). 18p. (AEC-tr-1822)

To conclusively explain the large disagreements between measurements by different authors of the thermal conductivity of organic liquids, new absolute measurements were performed using a spherical apparatus which agreed within an accuracy of 1% with values obtained with other apparatus. New measurements between −80 and +80°C for a larger number of liquids, together with reliable literature values, allow a general representation of the dependence of thermal conductivity of nonassociated liquids upon the reduced temperature from the viewpoint of the theorem of corresponding states. (auth)

2335

REACTIONS IN ARC ATMOSPHERE DURING SUBMERGED AUTOMATIC WELDING. V. V. Podgaetskii. Translated from Avtomat. Svarka 6, 10-18(1953). 15p. Available from Henry Brutcher (Trans. No. 3072), Altadena, Calif. (AEC-tr-1832)

The relationship between weld porosity and reactions in which H forms compounds insoluble in liquid steel and stable at the high arc temperatures is discussed. Thermodynamic computations of reactions of formation of HF and OH during submerged arc welding are presented. The formation of HF in arc atmosphere depends principally on the reaction between H and gaseous SiF_4. The formation of OH is possible in the presence of H_2, on the one hand, and of O, CO_2, and MnO and MgO on the other. (auth)

2336

THE ATOMIC WEIGHT OF LITHIUM FROM DENSITY AND X-RAY DATA. Dwight A. Hutchison (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 76, 967-9(1954) Feb. 20.

The atomic weight of lithium has been calculated from density and x-ray data to be $M_{Li} = 6.9364 \pm 0.0018$. This is less than the commonly accepted value of 6.940. A critical evaluation of previous work on the atomic weight of lithium does not preclude the present value. (auth)

2337

SOLID SOLUTIONS OF LITHIUM OXIDE IN NICKEL OXIDE. Peter J. Fensham (Bristol Univ., England). J. Am. Chem. Soc. 76, 969-71(1954) Feb. 20.

The effect of gaseous atmosphere and temperature of diffusion on the solid solution of lithium oxide in nickel oxide has been studied. It is shown that the partial pressure of oxygen present during the solid solution determines its character and extent. The absence of excess oxygen prevents the formation of a vacancy-free solid solution. The interoxide reaction proceeds to some extent at 600° but at this temperature it is probably limited to the surface layers. Even at 1100° the reaction within the interior of the oxide particles proceeds slowly. (auth)

2338

HEATS OF FORMATION OF TANTALUM, NIOBIUM AND ZIRCONIUM OXIDES, AND TANTALUM CARBIDE. George L. Humphrey (Bureau of Mines, Berkeley, Calif.). J. Am. Chem. Soc. 76, 978-80(1954) Feb. 20.

The heats of formation of tantalum pentoxide, niobium pentoxide, zirconium dioxide and tantalum carbide were measured by combustion calorimetry. The results are, respectively, -488.8 ± 0.5, -455.2 ± 0.6, -261.5 ± 0.2, and -38.5 ± 0.6 kcal/mole at 298.16°K. Corresponding free energy values were calculated. (auth)

2339

INTRAMOLECULAR ISOTOPE EFFECTS IN THE REACTIONS OF BENZONIC-α-C^{14} ANHYDRIDE. Vernon F. Raaen and Gus A. Ropp (Oak Ridge National Lab., Tennessee). J. Chem. Phys. 21, 1902-3(1953) Oct.

The reactions of benzonic-α-C^{14} anhydride with ethanol and toluidine were studied to ascertain the intramolecular isotope effects. A possible mechanism for the symmetry-destroying step is given. The isotopic ratios between the products of the reaction are tabulated and compared with the theoretical values. Temperature appears to cause no variation in the isotopic distribution. (J.S.R.)

2340

CARBON-14 ISOTOPE EFFECT IN THE EXCHANGE REACTION BETWEEN CARBON MONOXIDE AND PHOSGENE. D. R. Stranks (Univ. of Melbourne, Australia). J. Chem. Phys. 21, 2232(1953) Dec.

Carbon^{14} exchange-equilibrium constants were measured to explain why experimental values of C^{14} isotope effects in some unidirectional reactions appear to be larger than those predicted from the statistical-mechanical theory. Preliminary results for the exchange system $C^{14}O + COCl_2 \rightleftharpoons C^{14}OCl_2 + CO$ are given. At 10°C, a mixture of $C^{14}O$ (20 mm Hg) and $COCl_2$(88 mm Hg) contained in a quartz vessel illuminated with low-pressure Hg 2537 arc exhibits a half time of exchange of 40 min. at 405°C in the dark, a mixture of $C^{14}O$(14.5 mm Hg), $COCl_2$(15 mm Hg), and Cl_2(24.5 mm Hg) in a pyrex vessel has a half time of exchange of 360 min. The theoretical values of K were calculated from published isotopic-partition function ratios and compared with the experimental values. (J.A.G.)

2341

SOME PROPERTIES OF SODIUM AND POTASSIUM NEAR THEIR MELTING POINTS. L. G. Carpenter (Royal Aircraft Establishment, Farnborough, Hants., England). J. Chem. Phys. 21, 2224-5(1953) Dec.

An examination of how far the resistance, diffusion, and specific heat phenomena of Na and K near their melting point can be interpreted in terms of a common model is reported. (J.A.G.)

2342

THE OSMOTIC PROPERTIES OF AQUEOUS CAESIUM CHLORIDE + POTASSIUM CHLORIDE AND CAESIUM CHLORIDE AND CAESIUM CHLORIDE + LITHIUM CHLORIDE MIXTURES AT 25°C. R. A. Robinson (Univ. of Malaya, Singapore). Trans. Faraday Soc. 49, 1147-9(1953) Oct.

Isopiestic measurements were made on solutions of these mixtures. The CsCl + LiCl system shows marked deviations from simple behavior. (auth)

2343

SAFE HANDLING OF ALKALI METALS. (Argonne National Lab., Lemont, Ill.). Aug. 1, 1953. 26p.

This guide on the proper methods of handling alkali metals covers the following topics: the handling of Na, Li, and NaK; personal protective equipment; emergency tool panels; cleaning of equipment containing alkali metals; disposal area operations; fire prevention and firefighting; instructions on procedures in case of personal injury; and the use of respiratory equipment. (C.H.)

ANALYTICAL PROCEDURES

2344

Atomic Energy Research Establishment, Harwell, Berks (England)

THE DETERMINATION OF NIOBIUM IN STAINLESS STEEL. G. W. C. Milner and A. A. Smales. Dec. 21, 1953. 10p. (AERE-C/R-1311)

A procedure is described for the determination of the niobium content of stainless steels in which the niobium is first separated from many of the other steel constituents by precipitation with tannin and cinchonine from a slightly acid solution. Silica is employed as a carrier for the niobium precipitate, and after filtration and ignition the silica is removed as its volatile fluoride. The oxide residue is next fused with potassium bisulfate and the melt is dissolved by extracting with an aqueous solution of tartaric acid. The niobium concentration is finally determined absorptiometrically using the yellow coloration given with potassium thiocyanate. For accurate work it is necessary to incorporate Nb^{95} tracer to correct for small losses of niobium occurring in the chemical separation. However, the results obtained in the absence of radioactive niobium are generally satisfactory for the purposes of quality control. The determination of tantalum by radioactivation on the separated mixed earth acid oxides is also briefly discussed. (auth)

*2345

Hanford Works

COULOMETRIC DETERMINATION OF PHOSPHATE. W. N. Carson, Jr. and H. S. Gile. Nov. 19, 1953. Decl. Feb. 8, 1954. 9p. Contract W-31-109-Eng-52. (HW-30050)

A micro, volumetric determination of phosphate has been developed. The method is based on the use of a cation exchange resin to convert the sample to a mixture of acids, which is then titrated with base. The amount of base used between a methyl red endpoint (pH = 4.63) and a thymol blue endpoint (pH = 9.0) is the measure of phosphate in the sample and corresponds to the reaction: $NaH_2PO_4 + NaOH \rightarrow Na_2HPO_4 + H_2O$. Strong acid anions (sulfate, nitrate chloride, etc.) do not interfere; weak acid anions (carbonate, acetate, fluoride, etc.) interfere and must be removed. Electrolytic generation of base is used to minimize carbonate interference. Precisions are ±2-5% (standard deviation of single value) for 25 μl samples of 0.2 to 0.4M phosphate. (auth)

2346

Atomic Energy Project, Univ. of Calif., Los Angeles

STUDIES OF THE NEW HAMPSHIRE CHICKEN EMBRYO. 3. NITROGEN AND LIPIDE ANALYSIS OF ULTRACENTRIFUGAL FRACTIONS OF PLASMA. Ole Arne Schjeide. Mar. 1, 1954. 18p. Contract AT-04-1-GEN-12. (UCLA-281)

Total lipide and total N determinations were made on whole plasma and centrifugal fractions of the plasma of chicken embryos, chicks, roosters, and laying hens. The nitrogen and the lipide of whole plasma both increased during the incubation period, the N increasing at a more rapid rate, especially during the last three days of incubation. Of the two lipoprotein fractions investigated, the lighter (Lipoprotein I) displayed the more varying N-to-lipide ratios during development. The ratio at a given stage seemed to be conditioned both by the amount of protein present and by the nutritional state. A striking rise in the N-to-lipide ratio of this fraction was induced in the 4-day chick by fasting; this rise was much less marked after 500 r of whole-body x irradiation. Lipoprotein II was found to be present in relatively small but increasing amounts until three days before hatching. However, between 18 days of incubation and the time of hatching, Lipoprotein II almost tripled in amount and remained in relatively high concentration in all older animals. The lipide-to-nitrogen ratios of this component fell into three distinct classes at different stages even though the sedimentation rate for this component in each age group was the same. An appreciable amount of carbohydrate appeared to be present in this fraction. (auth)

2347

TITRATION IN NONAQUEOUS SOLUTIONS. 5. MORE OXIDIMETRIC TITRATIONS IN GLACIAL ACETIC ACID. O. Tomicek and J. Valcha. Translated from Chem. Listy 44, 283-91(1950). 27p. (AEC-tr-1821)

2348

THALLIUM-204 AS A STANDARD FOR RADIOASSAYS. S. A. Reynolds and W. A. Brooksbank, Jr. (Oak Ridge National Lab., Tennessee). Nucleonics 11, No. 11, 46-7(1953) Nov.

The use of Tl^{204} as a comparative standard for the radioassay of mixtures of nuclides is proposed. It meets criteria for standards, including radiochemical purity, sufficient supply, reasonably long and well-known half life, known particle and photon energies, and a well-established decay scheme. The techniques for use of Tl include (1) evaporation and counting of the unknown and comparison of the counting rate with that of a known amount of Tl and (2) a standard addition method. A comparison of the Tl standard method with the usual methods shows good agreement. (J.S.R.)

2349

SPECTROPHOTOMETRIC TITRATIONS WITH ETHYLENEDIAMINETETRAACETIC ACID(II). DETERMINATION OF MAGNESIUM, CALCIUM, ZINC, CADMIUM, TITANIUM, AND ZIRCONIUM. Philip B. Sweetser and Clark E. Bricker (Princeton Univ., N. J.). Anal. Chem. 26, 195-9(1954) Jan.

In an effort to extend the versatility of ethylenediaminetetraacetic acid (Versenate) as a volumetric reagent, the ultraviolet region of the spectrum has been studied for use in the spectrophotometric determination of the end point of Versenate titrations. A procedure is given for the use of the spectrophotometric and point in the determination of the combined content of Ca, Mg, Cd, and Zn, or for any one of these metals when present singly in NH_3-NH_4Cl buffered solutions; Ca in the presence of Mg; and Cd in the presence of Zn in NaOH solutions. A method for the determination of Zr involves the titration of an excess of Versenate with Fe(III) solution. A Ti–peroxide–Versenate complex was also found that was stable at low pH levels. The sensitivity of the spectrophotometric end point allows the use of Versenate solutions as dilute as 0.001M or less, even when the total volume of the solution being titrated is 100 ml. (auth)

2350

RADIOACTIVE GOLD IN FILTER PAPER ELECTROPHORESIS PATTERNS OF PLASMA. Norman Simon (Mount Sinai Hospital, New York). Science 119, 95-6 (1954) Jan. 15.

Filter paper electrophoresis is recommended as a

simple method for the separation of plasma proteins. Following the addition of colloidal Au^{198} to normal plasma in vitro, the distribution of Au^{198} in plasma fractions was determined by Geiger-Mueller tube counts of various areas in the electrophoretic pattern and confirmed by radioautographs of the same electrophoretic pattern. It was established that colloidal Au^{198} is bound to the α and β globulin fractions of plasma protein. (C.H.)

2351

POSSIBILITY OF MICRODETERMINATION OF CARBON IN ORGANIC COMPOUNDS BY THE NUCLEAR REACTION $^{12}_{6}C(d,n)^{13}_{7}N$. Pierre Süe. Compt. rend. 237, 1696-8(1953) Dec. 21. (In French)

Several experimental results have shown that the microdetermination of C in certain organic compounds should be possible by a direct measurement of the radioactive N activity. Several organic substances were irradiated and measured in microtubes of Si. (tr-auth)

2352

THE DETERMINATION BY RADIOACTIVATION OF THE OXYGEN CONTENT OF POWDERED METALS WITH PARTICULAR REFERENCE TO BERYLLIUM. R. G. Osmond and A. A. Smales (Atomic Energy Research Establishment, Harwell, Berks, England). Anal. Chim. Acta 10, 117-28 (1954) Feb. (In English)

A radioactivation method for the determination of oxygen in beryllium metal powder is described. The sample, mixed with lithium fluoride, is irradiated in the Harwell Pile. F^{18} is chemically separated and its activity compared with that from standards similarly treated. The method has given reproducible results in reasonable agreement with those obtained by several other methods which were being investigated simultaneously. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

2353

INTERCRYSTALLINE FILMS IN SINGLE CRYSTALS OF ALKALI HALIDE SALTS AND SOME OF THEIR PROPERTIES. L. M. Shamovskii [Shamovsky] and L. M. Rodionova. Translated from Doklady Akad. Nauk S.S.S.R. 92, 939-42 (1953). 4p. (NSF-tr-221)

The mechanism of the additive coloring of alkali halide salts is discussed briefly. Experimental proof is presented for the existence of intercrystalline films in single crystals of alkali halide salts, and the theory is presented that new color centers arising in a crystal phosphor are due to the localization of electrons in an activator placed at the intercrystalline surfaces. An energy scheme for a AgCl crystal is included. (C.H.)

DEUTERIUM AND DEUTERIUM COMPOUNDS

2354

THE HYDRIDE AND DEUTERIDE OF NIOBIUM AND TANTALUM. G. Brauer and R. Hermann (Univ. of Freiburg i. Br., Germany). Z. anorg. u. allgem. chem. 274, 11-23(1953) Dec. (In German)

The hydride and deuteride of Nb and Ti were synthesized from the elements, and their crystal structures were investigated by x-ray diagrams. In each of the systems two corresponding phases, α and β, of different constitution appeared. The homogeneous limits of the similar phases were determined approximately. The rhombic structure of the hydrogen-rich Ta hydride phase, already found by Hagg, was confirmed. The hydride and deuteride of Nb are therefore isotypes. Different experimental observations on the hydration and dehydration of Nb and Ta and the influence of N_2 traces are presented. (tr-auth)

FLUORINE AND FLUORINE COMPOUNDS

2355

Atomic Energy Research Establishment, Harwell, Berks (England)

THE CORROSION OF COPPER BY ELEMENTARY FLUORINE. (INTERIM STATEMENT OF RESULTS). P. E. Brown, J. M. Crabtree, and J. F. Duncan. Apr. 27, 1953. 16p. (AERE-C/R-1241)

Data are presented on the effects of pressure, temperature, and heating during interruption of fluorination on the corrosion of Cu by F_2. (A.G.W.)

2356

KINETICS OF THE FAST REACTION BETWEEN NITROGEN DIOXIDE AND FLUORINE. Richard L. Perrine and Harold S. Johnston (Stanford Univ., Calif.). J. Chem. Phys. 21, 2202-7(1953) Dec.

The rate of the reaction between NO_2 and F_2 to form NO_2F has been measured at 27.7, 50.4, and 70.2°. Light absorption by NO_2 was used to follow the reaction. By using a 22-liter Pyrex flask and by going to low concentrations of reactants, between 0.5 and 20×10^{-8} moles/cc, the rate of this fast reaction was reduced to a convenient value. The rate was found to be first order in each reactant, and it showed no dependence on NO_2F_2. The proposed mechanism is $NO_2 + F_2 \xrightarrow{k_1} NO_2F + F$ (slow) $NO_2 + F + M \xrightarrow{k_2} NO_2F + M$ (fast). The empirical second-order rate constant is k_1, that of an elementary bimolecular reaction. If the rate constant is written as $Aexp(-E/RT)$, then A is 1.6×10^{12} cc/moles/sec and E is 10.5 kcal. (auth)

2357

THE COMPLEXING OF INDIUM(III) BY FLUORINE IONS IN AQUEOUS SOLUTION: FREE ENERGIES, HEATS AND ENTROPIES. L. G. Hepler, John W. Kury, and Z. Z. Hugus, Jr. (Radiation Lab., Univ. of Calif., Berkeley). J. Phys. Chem. 58, 26-8(1954) Jan.

The potential of the ferrous-ferric half-cell has been studied as a function of the concentrations of HF and $In(ClO_4)_3$ at a total ionic strength of 0.5. The resulting data can be interpreted by assuming the existence of the ions InF^{+2} and InF_2^+. Equilibrium constants for the formation of these ions are calculated at 15, 25, and 35° and the free energy, heat, and entropy changes computed for the reactions: $In^{+3} + HF = InF^{+2} + H^+$ and $InF^{+2} + HF = InF_2^+ + H^+$. (auth)

GRAPHITE

2358

ELECTRONIC PROPERTIES OF CARBONS AND OF THEIR INTERSTITIAL BISULFATE COMPOUNDS. E. A. Kmetko, (Univ. of Buffalo, New York). J. Chem. Phys. 21, 2152-8 (1953) Dec.

The conductivity of graphite increases when it is oxidized into graphite bisulfate, this being the result of the expulsion of resonance electrons by the negative ions and the resulting creation of excess holes in the π band. This study concerns the electronic properties of the bisulfate compounds formed by the oxidation of carbons in H_2SO_4, the range of heat treatment of carbons extending from 1400 (baked carbons) to 3000°C (polycrystalline graphite). The resistivities of all samples thus treated decrease with increase in the degree of oxidation. The rate of decrease in resistance depends upon the heat treatment, the rate being increasingly greater for samples treated to higher temperatures. The curve of the Hall constant of unoxidized carbons vs. the heat-treatment temperature H has a sharp positive peak at about H = 2000°C. The curve rapidly drops on either side of the peak, the coefficient becoming negative and exhibiting a minimum around H = 1400°C. The

thermoelectric power of all samples studied becomes more positive with oxidation, with maxima appearing for lamellar compounds. The rate of the initial rise is greater for higher heat-treatment temperatures. The temperature coefficient of resistance depends strongly upon the ion concentration, changing from negative to positive for carbons heat treated above 2000°C. On the other hand, the coefficients remain negative and are remarkably independent of ion concentration for carbons treated to temperatures below 2000°C. The results are in general consistent with the electronic model for carbons proposed by Mrozowski whereby the Fermi level is initially depressed during devolatilization of the hydrocarbon material by the formation of a large number of excess holes (heat treatments below 1400°C) and later steadily rises with the growth of the crystallites towards the top of the π band, the growth of the crystal planes resulting also in a steady decrease of the energy gap between the π and conduction bands. The negative Hall coefficient for baked carbons indicates the π band to be so depleted that the Fermi level drops at least partially below the inflection curve. At room temperature the conduction is therefore semimetallic in nature for carbons treated to H <2000°C in contrast with cases for which H>2000°C where the number of excess holes is relatively small and the current is carried mainly by the holes and electrons thermally activated into the conduction band. (auth)

2359

BAND STRUCTURE OF GRAPHITE. J. L. Carter and J. A. Krumhansl (Cornell Univ., Ithaca, N. Y.). J. Chem. Phys. 21, 2238-9(1953) Dec.

The lattice symmetry restrictions on the band structure of graphite have been examined in greater detail because of previous discrepancies in theoretical interpretations of results based on the Wallace theory (Phys. Rev. 71, 622 (1947)). (J.A.G.)

2360

HEAT OF WETTING OF COPPER, GRAPHITE AND SILICA GEL. F. E. Bartell and R. Murray Suggitt. (Univ. of Michigan, Ann Arbor). J. Phys. Chem. 58, 36-40(1954) Jan.

Determinations were made of the unit area heats of wetting and net heats of adsorption of ten liquids on graphite and of five liquids each on silica gel and on Cu powders. Evidence is presented to show that unit area heats of wetting values are reproducible if certain conditions are met. Comparison of the unit area heats of wetting of graphite and of Cu showed that the heat of wetting of Cu is much greater than the heat of wetting of graphite. This finding is opposite to that reported by others. Contrary to results reported in the literature, the presence of moisture was found to have no applicable effect on the heats of wetting of graphite by hydrocarbons. The effect of O_2, dissolved in water, on the heat of wetting of Cu was determined. Evidence is presented to show that the net heat of adsorption of water on graphite is negative, and that negative net heats of adsorption are characteristic of liquid–solid systems that form contact angles. A description is given of the microcalorimeter used for the measurement of the heats of wetting of the low surface area powders. Various experimental aids used in the measurements are set forth, and two correction terms arising from the breaking of glass sample bulbs are shown to be necessary. (auth)

LABORATORIES AND EQUIPMENT

2361

Atomic Energy Research Establishment, Harwell, Berks (England)

REMOTE HANDLING EQUIPMENT. A. Apperly. Nov. 2, 1953. 45p. (AERE-E/R-1291)

Some remote-handling devices designed over the last few years have been standardized for use at AERE, Harwell. These items are only a selected few, and of the remainder this report shows briefly what are available. Where items have been standardized the catalog number is given. This signifies that demands can be met by direct application, with the catalog number, to AERE, Main Stores, Harwell. Items that have not as yet been standardized, but are in general use sufficiently to warrant the keeping of small stocks, are shown as "RHG stock." Items in excess of economical storage, or which are not generally in demand, for which drawings or records exist, are indicated by "Request." Prototype and development equipment, for which records or drawings do not exist, are shown "Special." Delivery time for these items will have to take into account time for drawing and design as well as for manufacture. (auth)

MOLECULAR STRUCTURE

2362

Ames Lab.

MOLECULAR CALCULATIONS. 2. METHODS OF APPROXIMATION OF MOLECULAR INTEGRALS. Frank O. Ellison. Sept. 1, 1953. 41p. Contract [W-7405-eng-82]. (ISC-402)

(For preceding report in series see ISC-459.)

2363

Ames Lab.

MOLECULAR CALCULATIONS. 3. A MODIFICATION OF THE NAIVE SEMI-EMPIRICAL MO METHOD. Lionel Goodman and Harrison Shull. Feb. 1, 1954. 44p. Contract W-7405-eng-82. (ISC-446)

(For preceding report in series see ISC-402.)

RADIATION CHEMISTRY

2364

IRRADIATION OF AQUEOUS CHLORAL HYDRATE SOLUTIONS WITH Co^{60} GAMMA-RAYS. AVERAGE LIFETIME OF THE FREE RADICAL CHAINS. G. R. Freeman, A. B. Van Cleave, and J. W. T.Spinks (Univ. of Saskatchewan, Saskatoon, Canada). Can. J. Chem. 32, 322-6(1954) Mar.

When aqueous 1M chloral hydrate solutions are irradiated with x rays or γ rays, hydrochloric acid is produced. The reaction appears to be a chain reaction. The average free-radical chain lifetime, as determined using a rotating sector, is approximately 0.1 sec. (auth)

2365

THE PRIMARY RADICAL YIELD IN WATER. A COMPARISON OF THE PHOTOLYSIS AND RADIOLYSIS OF SOLUTIONS OF HYDROGEN PEROXIDE. F. S. Dainton and J. Rowbottom (Univ. of Leeds, England). Trans. Faraday Soc. 49, 1106-73(1953) Oct.

A method is described for investigating the kinetics of the decomposition of an aqueous solution of H_2O_2 irradiated successively with ultraviolet light and with γ rays from Co^{60}, using either continuous or intermittent irradiation. The rates of both reactions are proportional to the first power of the concentration of H_2O_2 and to the square root of the radiation intensity, and they have the same temperature coefficients. The value of the limiting quantum yield for the photolysis at high light intensities is observed to be 1.9, and the primary radiation yield is computed to be 12.6 ± 1.8 water molecules decomposed per 100 ev. This result is discussed in the light of current theories. (auth)

2366

THE CHEMICAL EFFECTS OF RADIATIVE THERMAL NEUTRON CAPTURE. PART 1. PERMANGANATES. K. J. McCallum and A. G. Maddock (Chemistry Lab., Pembroke

Street, Cambridge, England). Trans. Faraday Soc. 49, 1150-9(1953) Oct.

The chemical effects resulting from the capture of thermal neutrons by Mn in different crystalline permanganates has been investigated. The retention of radioactive Mn in the form of the permanganate ion was investigated in its dependence upon the pH of the solution in which the irradiated crystals were dissolved. Explanations for the observed behavior are discussed. (auth)

2367

THE X- AND γ-RAY OXIDATION OF FERROUS SULPHATE IN AQUEOUS SOLUTION. H. A. Dewhurst (Univ. of Edinburgh, Scotland). Trans. Faraday Soc. 49, 1174-90(1953) Oct.

The oxidation of aqueous $FeSO_4$ solutions by 50-kv peak x rays and Co^{60} γ rays has been investigated in aerated and air-free solution. The results of the present investigation are not in complete accord with those of recent studies of the radiation-induced oxidation of $FeSO_4$, particularly at low acid concentrations. The lack of complete agreement between theory and experiment indicates either that the reaction scheme is incomplete or that the treatment of the reaction scheme by stationary-state homogeneous kinetics is unsatisfactory. The results also indicate that the difference in the spatial distribution of the radicals produced by the x rays and γ rays is not an important factor in determining the kinetics of oxidation. (auth)

2368

THE MECHANISM OF GAS PHASE RADIATION-CHEMICAL REACTIONS. Harry Essex (Syracuse Univ., N. Y.). J. Phys. Chem. 58, 42-9(1954) Jan.

From the effect of electric fields on the ion yield, and other experimental data, the extent can be calculated to which a gaseous radiation-chemical reaction is initiated by each of four primary mechanisms. Both published and new data are used to illustrate the methods for calculating the ion yield attributable to each mechanism. The effect of the nature of the irradiation on the ion yields and the maximum ion yields possible for each mode of initiation are discussed. (auth)

RADIATION EFFECTS

2369

THE EFFECTS OF IONIZING RADIATION ON HETEROGENEOUS CATALYSTS — ZINC OXIDE AS A CATALYST FOR THE HYDROGENATION OF ETHYLENE. Ellison H. Taylor and John A. Wethington, Jr. (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 76, 971-3(1954) Feb. 20.

Irradiation with γ rays lowers the catalytic activity of ZnO for the hydrogenation of ethylene. There is some evidence that this is the result of electronic changes produced in the catalyst by the radiation, although the possibility of poisoning by radiation-polymerization of residual ethylene is not definitely excluded. The possible utility of such experiments in the study of heterogeneous catalysis is indicated. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

*2370

Los Alamos Scientific Lab.

PREPARATION OF MASSIVE SAMARIUM METAL. E. I. Onstott. Dec. 1953. 8p. Contract W-7405-eng-36. (LA-1622)

Massive samarium metal of relatively high purity is made by heating a mixture of approximately 20-mesh barium metal and powdered anhydrous samarium(III) bromide. This mixture, contained in a tantalum crucible in an argon atmosphere, is heated to 1650 to 1700°C for about 20 minutes. The heating serves to agglomerate and separate the metal and distill out excess barium. A yield of about 10 g of metal, or 50%, is obtained with a batch of 50 g of bromide and 30 g of barium. Samarium metal distills at an appreciable rate when heated in an argon atmosphere at about 1700°C. Density data obtained on massive samarium metal samples are: metal as made, 7.499 g/cc; recast metal, 7.509 g/cc; distilled metal 7.495 g/cc. (auth)

2371

MEASUREMENT OF THE IRREGULAR LATTICE DISORDER AND THE ELECTRICAL RESISTANCE IN THE $ThO_2-La_2O_3$ SYSTEM. F. Hund (Technische Hochschule, Stuttgart, Germany). Z. anorg. u. allgem. Chem. 274, 105-13(1953) Dec. (In German)

From pure ThO_2 to the fluorite-type mixed crystal with 25.0 and 46.6 mole % La_2O_3 the absolute heat-vibration lattice disorder was determined. The measured disorder value of ThO_2 was $0.45 \pm 0.04 \times 10^{-16}$ cm^2, that of the 25% mixed crystal was $0.75 \pm 0.03 \times 10^{-16}$ cm^2, and that of 46.6% mixed crystal was $1.52 \pm 0.03 \times 10^{-16}$ cm^2. The pure temperature disorders of the different lattices in a concentration sequence were calculated to increase from 0.30 to 0.33 to 0.35×10^{-16} cm^2. By a comparison of all values, the heat-vibration lattice disorder in the thermodynamically stable system can be reduced to the disordering of the mixed crystal systems caused by increasing concentration of La_2O_3. The temperature dependence of the specific electrical resistance was measured on the same crystals and the conductivity determined as a function of the electrolytic O-ion lattice defects. The relation between the specific resistance and the measured disorder value is not known. (tr-auth)

2372

ION EXCHANGE AS A SEPARATIONS METHOD. VII. NEAR OPTIMUM CONDITIONS FOR THE SEPARATION OF FISSION PRODUCT RARE EARTHS WITH LACTIC ACID ELUANT AT 87°. Edward C. Freiling and Leland R. Bunney (U. S. Naval Radiological Defense Lab., San Francisco). J. Am. Chem. Soc. 76, 1021-2(1954) Feb. 20.

An ion exchange method is presented for the virtually complete separation of Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, and Tb from one another in 49 hr using lactic acid eluants of various strengths at a pH of 3 and a temperature of 87°. (J.S.R.)

SEPARATION PROCEDURES

2373

THE SEPARATION OF NIOBIUM AND TANTALUM BY THE FUSION-EXTRACTION METHOD. (STUDIES ON THE SEPARATION OF ELEMENTS OF SIMILAR PROPERTIES IV). Kozo Nagashima and Shizno Fujiwara. Translated by Toshio Nakai from J. Chem. Soc. Japan 74, 383-5(1953). 8p. (AEC-tr-1790)

The separation of Nb and Ta by fusion of Nb_2O_5 and Ta_2O_5 with KNO_3, KCl, KCl + KOH, Na_2CO_3, K_2CO_3, or Na_2CO_3 + K_2CO_3 with the addition of K_2HPO_4 in each case is reported. The melt is then cooled quickly, powdered, and extracted in a solution of oxalic acid and ammonium oxalate. A precipitate of Ta is obtained by acidifying with oxalic acid and the slow addition of tannic acid solution. Nb is then obtained as a precipitate by the addition of NH_4OH to the filtrate. The efficiency of extraction was 80 to 90%. Results show that KCl was the best fusing agent, but, in this case, fusion time must be shortened. (J.A.G.)

2374

ANION-EXCHANGE STUDIES. IX. ADSORBABILITY OF A NUMBER OF METALS IN HYDROCHLORIC ACID SOLUTIONS. Kurt A. Kraus, Frederick Nelson, and Gilbert W. Smith (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 58, 11-17(1954) Jan.

The results of anion-exchange studies in HCl solutions of the alkali metals, ammonium ions, alkaline earths, elements of Group III, Ti and V, and of Pd, Ir, and Pt are given. Negligible adsorption is shown by the alkali metals, ammonium ions, alkaline earths, Al(III), Y(III), and rare earths. Ti(III), V(III), V(IV), and Sc(III) are slightly adsorbed from concentrated HCl, while Ti(IV) and V(V) show considerable adsorption under these conditions. In(III) shows some adsorption between 0.5 and 12M HCl, and Ga(III) excellent adsorption, with adsorption increasing to 7M HCl and decreasing beyond this molarity. Tl(III), Pd(II), and Pt(IV) show excellent adsorption between 0.1 and 12M HCl with adsorption generally decreasing in this range. Ir(III) is negligibly adsorbed in the same range, but adsorbs at very low HCl concentrations. Some implications of these results on separations are illustrated. A striking parallel between anion-exchange adsorption and solvent extraction by ethers is discussed. (auth)

SORPTION PHENOMENA

2375

DETERMINATION OF THE KINETICS OF ADSORPTION OF ORGANIC SUBSTANCES BY MEASUREMENTS OF THE DIFFERENTIAL CAPACITY AND THE CONDUCTANCE OF THE BOUNDARY BETWEEN ELECTRODES AND SOLUTIONS. A. Frumkin and V. I. Melik-Gaikazyan. Translated from Doklady Akad. Nauk S.S.S.R. 77, 855-8(1951). 5p. (AEC-tr-1830)

SPECTROSCOPY

2376

Johns Hopkins Univ.

THE MOLECULAR SPECTRA OF TRITIUM AND RELATED SPECTRA. [PART] 4. PROGRESS REPORT. G. H. Dieke. May 1952. 30p. Contract AT(49-1)-309. (NYO-694)

(For preceding period see NYO-693.)

2377

A GENERALIZED EQUATION FOR THE TRANSFORMED DENSITY FUNCTION. E. E. [Ye.] Vainshtein. Translated from Doklady Akad. Nauk S.S.S.R. 92, 723-5(1953). 3p. (NSF-tr-205)

SYNTHESES

2378

Harvard Univ.

CYCLOPENTADIENYL COMPOUNDS OF MANGANESE AND MAGNESIUM. G. Wilkinson and F. A. Cotton. Mar. 1, 1954. 6p. Contract AT-(30-1-1461). (NYO-6378)

2379

Florida Univ.

STUDIES IN THE PREPARATION AND PROPERTIES OF QUATERNARY AMMONIUM ION EXCHANGE RESINS. QUARTERLY PROGRESS REPORT NO. 4 [FOR] MARCH 15, 1953 TO JUNE 15, 1953. Armin H. Gropp, George B. Butler, Rudolph J. Angelo, and William J. Husa. June 15, 1953. 32p. Contract AT-(40-1)-1353. (ORO-111)

The properties of quaternary ammonium ion exchange resins prepared by the polymerization of unsaturated quaternary ammonium salts were investigated. 1,4-Bis(diallylamino)butane has been obtained by lithium aluminum hydride reduction of N,N,N′,N′-tetraallyl succindiamide. This method will be extended to reduction of N,N,N′,N′-tetraallylglutardiamide in an effort to prepare 1,5-bis(diallylamino)pentane. Further attempts have been made to bridge the gaps between two and ten methylene groups between reactive centers in the suspension polymer series. Additional quantities of the nonamethylene and decamethylene derivatives have been prepared and suspension polymers prepared from these monomers. Equilibrium titration curves have been completed for five of the resins previously prepared and described. This study has revealed several interesting indications as to the properties of these compounds. (auth)

2380

PREPARATION OF UNSATURATED HYDROCARBONS TAGGED WITH C^{14}. T. I. Andrianova and E. A. Andreev [Ye. A. Andreyev]. Translated from Doklady Akad. Nauk S.S.S.R. 87, 45-7(1952). 7p. (AEC-tr-1823)

2381

PREPARATION OF ALCOHOLS TAGGED WITH C^{14}. T. I. Andrianova and E. A. Andreev [Ye. A. Andreyev]. Translated from Doklady Akad. Nauk S.S.S.R. 86, 1105-8(1952). 9p. (AEC-tr-1824)

2382

PREPARATION OF ACETYLENE AND ETHANE TAGGED WITH RADIOACTIVE CARBON C^{14}. N. P. Keier [Keyer], B. V. Klimenok, and G. V. Isagulyants. Translated from Doklady Akad. Nauk S.S.S.R. 85, 1029-31(1952). 7p. (AEC-tr-1825)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 7-3748.

2383

PREPARATION OF ESTERS OF CARBOXYLIC ACIDS TAGGED WITH C^{14}. T. I. Andrianova and E. A. Andreev [Ye. A. Andreyev]. Translated from Doklady Akad. Nauk S.S.S.R. 86, 945-7(1952). 6p. (AEC-tr-1826)

2384

SYNTHESIS OF ETHYL ALCOHOL TAGGED WITH CARBON ISOTOPE C^{14}. T. I. Andrianova, E. A. Andreev [Ye. A. Andreyev], and O. M. Sokolova. Translated from Doklady Akad. Nauk S.S.S.R. 88, 677-8(1953). 4p. (AEC-tr-1827)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 7-3057.

2385

SYNTHESIS OF ACETALDEHYDE TAGGED WITH RADIOACTIVE CARBON. M. B. Neyman and G. I. Feklisov. Translated from Doklady Akad. Nauk S.S.S.R. 87, 605-8 (1952). 9p. (AEC-tr-1828)

2386

SYNTHESIS OF 1-C^{14} PENTANE AND 3-C^{14} PENTANE. A. F. Lukovnikov, M. B. Neyman, A. A. Bag, L. M. Rodionova, I. S. Samoukina, and N. V. Bliznyak. Translated from Doklady Akad. Nauk S.S.S.R. 88, 297-300(1953). 10p. (AEC-tr-1829)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 7-3054.

TRACER APPLICATIONS

2387

Brookhaven National Lab.

DISPLACEMENT MECHANISMS IN ENZYMATIC REACTIONS. ALKALINE PHOSPHATASE. Daniel E. Koshland, Jr. and Sylvia S. Stein. [1953] 24p. (BNL-1709)

The interaction of alkaline phosphatase from calf intestinal mucosa and its substrates has been studied in O^{18}-labeled water. It was found that a wide variety of substrates are hydrolyzed by phosphorus-oxygen cleavage, the enzyme catalyzes an exchange of O between the water and inorganic phosphate, and no appreciable O^{18} was observed in the unhydrolyzed ester. These facts are shown to be consistent with a displacement mechanism for the enzymatic action and to support the assumption that the precise orientation of catalytic groups requires that all substrates of an enzyme be cleaved at the same point. The presence or absence of O^{18} in the unhydrolyzed ester is shown to be a new criterion which can give unequivocal evidence for a single displacement mechanism but will not lead to a unique mechanism in all cases. The implications in relation to exchange criteria for enzyme mechanisms

and the relationship of hydrolytic to group transfer mechanisms are discussed. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

2388

Los Alamos Scientific Lab.

MEASUREMENT OF PLUTONIUM LIQUID DENSITY. A. Allen Comstock and R. B. Gibney. Jan. 21, 1952. Decl. Feb. 12, 1954. Contract W-7405-eng-36. (LA-1348)

The density of molten plutonium has been determined by measuring the volume of a known weight of liquid plutonium in a quartz tube. The method involved the use of an x-ray shadowgraph technique. The density was found to be 16.5 ± 0.08 gm/cm^3 at about 665°C. From the shapes of 2 different plutonium menisci, as observed in the shadowgraphs, a rough value of 100 dyne/cm was calculated for the surface tension. Also, a rough value of 5×10^{-5} was calculated for the coefficient of thermal expansion. Both of these were obtained in the region around 700°C. (auth)

*2389

Radiation Lab., Univ. of Calif., Berkeley

VAPOR-PRESSURES OF AMERICIUM TRIFLUORIDE AND AMERICIUM METAL (thesis). Stephen Charles Carniglia. Nov. 1953. 76p. Contract W-7405-eng-48. (UCRL-2389)

The vapor pressures of plutonium trifluoride, americium trifluoride, and americium metal have been measured by a modification of the Knudsen effusion method. The measurements on PuF_3, made to provide a basis against which to refer the other data, agreed remarkably well with previously published results. The vaporization equations obeyed by this substance over the temperature range 1220 to 1450°K are $\log p_{(mm)} = 12.018 - 20{,}520/T$, or, assuming $\Delta C_{p(sublim)} = -14$ cal/mole/degree, $\log p_{(mm)} = 37.119 - 24{,}625/T - 7.046 \log T$. The data for AmF_3 showed a detectable curvature. The points were fitted by the equation (assuming also $\Delta C_{p(sublim)} = -14$ cal/mole/degree) $\log p_{(mm)} = 36.880 - 24{,}650/T - 7.046 \log T$, over the temperature range 1120 to 1470°K. The vapor pressure of americium metal obeyed the equation $\log p_{(mm)} = 7.563 - 13{,}162/T$, or, assuming $\Delta C_{p(vap)} = -2$, $\log p_{(mm)} = 11.092 - 13{,}700/T - \log T$, from the melting point, 1100°K, to 1450°K. The apparatus, an opposed twin device permitting simultaneous vaporization of a reference substance and the substance under study, is described in detail. Derived thermodynamic quantities are presented, and uncertainties attending each measurement are discussed. (auth)

2390

CHEMISTRY AND ACTINIDE THEORY OF THE TRANSURANIC ELEMENTS. R. Nast and T. von Krakkay. Translated from Fortschr. chem. Forsch. 2, 484-537(1952). 44p. (AEC-tr-1622; AERE-Trans-11/3/5/277)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 6-3263.

TRITIUM AND TRITIUM COMPOUNDS

2391

Chicago Univ.

RESEARCH TO ASSAY RAIN AND SURFACE WATER FOR NATURAL TRITIUM CONTENT. QUARTERLY REPORT FOR THE PERIOD DECEMBER 1, 1953 THROUGH FEBRUARY 28, 1954. W. F. Libby. Mar. 1, 1954. 4p. Contract AF-18(600)-564. (NP-5076)

Results are tabulated from assays for natural tritium content of rain and surface waters collected at various locations, and wines of various vintages and from various locations. (For preceding period see NP-4990.) (C.H.)

URANIUM AND URANIUM COMPOUNDS

2392

Argonne National Lab.

REFRACTIVE INDICES OF THE SYSTEMS URANIUM HEXAFLUORORIDE – BROMINE TRIFLUORIDE AND URANIUM HEXAFLUORIDE – BROMINE PENTAFLUORIDE. Lawrence Stein and Richard C. Vogel. May 25, 1953. Decl. Mar. 3, 1954. 16p. Contract W-31-109-eng-38. (ANL-5051)

A spectrometer has been used with a hollow prism electrically heated to 70°C to measure the refractive indices of solutions of uranium hexafluoride in bromine trifluoride and uranium hexafluoride in bromine pentafluoride. The refractive indices of the two binary systems have been expressed as a function of composition. The equations obtained are:

$$n_D^{70} = 1.4302 - 0.1123\ N_1 + 0.0484\ N_1^2 - 0.0083\ N_1^3$$

$$n_D^{70} = 1.3275 + 0.0380\ N_2 - 0.0065\ N_2^2 - 0.0010\ N_2^3$$

where n_D^{70} = refractive index, N_1 = mole fraction of UF_6 in BrF_3, N_2 = mole fraction of UF_6 in BrF_5. (auth)

2393

Argonne National Lab.

SOLID-LIQUID PHASE EQUILIBRIA IN THE CONDENSED SYSTEM URANIUM HEXAFLUORIDE-BROMINE PENTAFLUORIDE. Jack Fischer and Richard C. Vogel. Nov. 27, 1953. Decl. Mar. 3, 1954. 6p. Contract W-31-109-eng-38. (ANL-5167)

Investigation of the system uranium hexafluoride-bromine pentafluoride has shown that the system is a simple eutectic type. The solid phases are the pure components. The system exhibits only slight deviation from ideality. (auth)

2394

Argonne National Lab.

PHOTOCHEMISTRY OF URANYL COMPOUNDS. Eugene Rabinowitch. Jan. 1954. 98p. Contract W-31-109-eng-38. (ANL-5202)

The photochemical reactions of uranyl compounds (aliphatic and substituted aliphatic acids) with inorganic and organic compounds are reviewed, and an attempt is made to establish correlations between the different studies. As the reactions are slow and much of the study was done by insufficiently precise methods, the correlation is difficult and contains many contradictions. (J.S.R.)

2395

Brookhaven National Lab.

PHOTOCHEMICAL ACTIVITY OF SALTS OF URANIUM IN SOLUTIONS AT THE TEMPERATURE OF LIQUID NITROGEN. Simon Freed and Kenneth M. Sancier. [nd] 10p. (BNL-1695)

Anhydrous chlorides of hexavalent (UO_2^{++}), quadrivalent, and trivalent uranium ions are photochemically active when in a solution fluid at 77°K. The solvent consisted of 10% n-propanol, 45% propane, and 45% propene. It was shown spectroscopically and also chemically that quadrivalent uranium was reduced to the trivalent form. There were indications that trivalent and hexavalent uranium were transformed photochemically to the tetravalent state. (auth)

*2396

Carbide and Carbon Chemicals Co. (K-25)

THERMAL DECOMPOSITION OF URANYL NITRATE HEXAHYDRATE. W. S. Wendolkowski and S. S. Kirslis. Feb. 22, 1954. 23p. Contract W-7405-eng-26. (K-1086)

The thermal decomposition of uranyl nitrate hexahydrate was studied at 41.8, 75.6, and 126.3°C by observing the equilibrium pressure over the salt as the water of hydration

was gradually removed. Constant equilibrium pressures were observed which corresponded to the hexahydrate, trihydrate, and dihydrate phases. For the transition $UO_2(NO_3)_2 \cdot 6\ H_2O \rightarrow UO_2(NO_3)_2 \cdot 3\ H_2O + 3\ H_2O(g)$, the variation of the quilibrium water vapor pressure with temperature is described by the equation $\log P = 2396/T + 9.010$, where P is in millimeters and T is the absolute temperature. The heat of dehydration calculated from this relation was 10.9 kcal/mole of water. The trihydrate decomposed according to the equation $UO_3(NO_3)_2 \cdot 3\ H_2O \rightarrow UO_3(NO_3) \cdot 2\ H_2O + H_2O(g)$. The plot of log P vs. 1/T showed curvature in this case, but the data may be approximately represented by the equation $\log P = -3277/T + 10.926$, where the units are the same as above. The average heat of this dehydration was 15.0 kcal/mole of water released. The decomposition pressure of the dihydrate at 126.3°C was approximately 20 mm. Visible quantities of brown nitrogen tetroxide fumes were observed during this decomposition, but the vapor withdrawn was largely water. The main decomposition reactions can be represented by the equations $UO_2(NO_3)_2 \cdot 2\ H_2O \rightarrow UO_2(NO_3)_2 + 2\ H_2O(g)$ and $UO_2(NO_3)_2 \cdot 2\ H_2O \rightarrow UO_3 + N_2O_4(g) + 2\ H_2O(g) + 0.5\ O_2(g)$. (auth)

*2397

Atomic Energy Project, Univ. of Rochester

POLYMERIZATION OF URANYL-CITRATE,-MALATE,-TARTRATE, AND -LACTATE COMPLEXES. I. Feldman, J. Havill, and W. Neuman. Feb. 23, 1954. 28p. Contract W-7401-eng-49. (UR-315)

Titrimetric and spectrophotometric studies have led to the following conclusions. When equimolar mixtures of uranyl nitrate and citric, tartaric, and malic acids are raised to pH 3.5, practically all the uranium reacts with the organic groups by tridentate chelation to form complexes of 1:1 molar ratio which are dinuclear. The dimers are held together by an oxygen bridge or by two hydroxyl bridges between two uranium atoms. At slightly alkaline pH these dimers react completely to form trinuclear complexes. There exist two trimers, having uranium/organic group ratios of 3:3 and 3:2. The stability of the 3:3 trimer relative to the 3:2 trimer decreases in the order −UMal > UTar > UCit — probably because of electrostatic effects. It is believed that steric hindrance to linearity of the (O=U=O) group produced by the tridentate chelation causes the promotion of 5f electrons of uranium to the 6d level with either an accompanying hydration of one of the originally double-bonded oxygens of the uranyl group or formation of the bent resonance hybrid ($U^{+} \swarrow^{O^{-}}_{O}$).

Possible structures for the polymers are presented and discussed. Titration results also indicate dimerization and trimerization of the uranyl−lactate complex in an equimolar mixture. (auth)

2398

VOLATILE ORGANIC URANIUM COMPOUNDS [Über flüchtige organische Uranverbindungen]. Henry Albers, Martin Deutsch, Walter Krastinat, and Horst von Osten. Translated from Chem. Ber. 85, 267-78(1952). 24p. (AEC-tr-1719)

Alcoholates, 1,3-diketone complexes and complex alkoxo compounds are prepared to test the volatility and solubility of organic U(IV) compounds. Uranium(IV)-aluminum isopropylate is characterized by a relatively high volatility and solubility. (auth)

2399

DIMORPHISM OF URANIUM SULFIDE, US_2. M. Picon and J. Flahaut. Translated from Compt. rend. 237, 808-10(1953). 2p. (AEC-tr-1812)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-193.

WASTE DISPOSAL

*2400

Los Alamos Scientific Lab.

DESIGN AND PERFORMANCE OF AN EFFLUENT PLANT FOR RADIOACTIVE WASTES. J. A. Leary, R. A. Clark, and R. P. Hammond. Jan. 20, 1954. 20p. Contract [W-7405-eng-36]. (AECU-2818)

The design and process efficiency of a kilocurie waste gas and liquid processing and disposal plant are described. Provisions were made for storage and handling of high-level γ-emitting liquids, dusts, and fumes, typical of wastes from a radiochemical processing laboratory. Separate waste streams for α emitters are employed. Design capacity of the system is 2 gpm of liquid and 30,000 cfm of air. (K.S.)

ENGINEERING

*2401

Polytechnic Inst. of Brooklyn

DEFORMATIONS AND STRESSES IN CIRCULAR CYLINDRICAL SHELLS CAUSED BY PIPE ATTACHMENTS. PART 4. WORK CHARTS. Joseph Kempner. Feb. 1953. 72p. Contract W-31-109-eng-52, Subcontract K-130 to Knolls Atomic Power Lab. (KAPL-924)

As a first step in the analysis of shells loaded by pipe attachments, a method was developed (KAPL-922) for the determination of deformations and stresses in circular cylindrical shells under the action of concentrated or approximately concentrated loads. Most of the results (KAPL-922) are presented in a form suitable for efficient computation of the significant displacement and stress quantities. Experience has shown that the use of an extensive set of tables expedites the numerical work involved in the analysis of a given shell. Such a set of tables is constructed on the basis of the displacement and stress equations presented. These tables enable a computer to determine the radial displacements, slopes, bending stresses, and membrane stresses in a circular cylindrical shell simply supported at its ends and loaded midway between the ends by approximately concentrated (or concentrated) radial forces, axial moments, and circumferential moments. It is also shown that the tables can be adapted to a shell analysis for applied radial forces, axial moments, and circumferential moments, away from the midpoint of the loaded generator of the shell. (For preceding report in series see KAPL-923.) (J.A.G.)

2402

Standard Oil Co. of Ind.

DEVELOPMENT AND EVALUATION OF HIGH TEMPERATURE GREASES. QUARTERLY REPORT NO. 11. Edward A. Swakon and Robert Steinbruch. Jan. 1954. 19p. Contract AF 33(038)-23687. (NP-5099)

Greases comprising arylureas and silicone fluid continue to show promise of satisfying the Air Force requirements for a grease suitable for the temperate range of −65° to 450°F. Because of inherent limitations of silicone fluid, these greases do not meet the specifications on gear wear and on rheological properties at −65°F. A new arylurea grease was made and consists of DC 550 Silicone Fluid, 1,4-bis-[3-(p-biphenylyl)-ureido]-benzene and a rust inhibitor. It is similar to the other arylurea greases in its properties plus having better rust preventive properties. Nine additives were screened for improving the lubricity of silicone greases on the Navy gear wear tests. None of the greases met the gear wear specification nor did any of the additives improve the lubricity significantly.

Greases made with either an untreated silica or with an organic-coated silica and five types of silicone fluids were found to be mechanically unstable after being heated at an elevated temperature. Ten bearing tests were completed during this period on the ABEC-NLGI Bearing Tester operating at 450°F and 10,000 rpm. The results of seven tests on formulations made with DC 550 Silicone Fluid ranged from 318 hours to 961 hours. The results of three tests on formulations made with two new experimental fluids which can meet the −65°F temperature requirements ranged from 49 to 449 hours. (auth)

2403

Naval Research Lab.

A GASKETLESS JOINT FOR APPLICATION TO HIGH TEMPERATURE, HIGH-PRESSURE WATER SYSTEMS. G. M. Dinnick. Mar. 10, 1954. 4p. (NRL-4336)

A simple, relatively inexpensive means has been devised for assembling high-pressure, high-temperature piping without gaskets. The satisfactory performance of the joint has been demonstrated in a number of tests. The joint should offer advantages of size, cost, ease of assembly and disassembly, and freedom from contaminating and corroding materials for joining high-pressure, high-temperature piping. The principle should be capable of extension to materials other than the stainless steel for which it was designed. (auth)

HEAT TRANSFER AND FLUID FLOW

2404

Brookhaven National Lab.

HEAT TRANSFER RATES FOR CROSS-FLOW OF WATER THROUGH A TUBE BANK AT REYNOLDS NUMBERS UP TO A MILLION. PART 2. CIRCUMFERENTIAL VARIATION OF FILM COEFFICIENT FOR INDIVIDUAL TUBES. O. E. Dwyer, T. V. Sheehan, and Joel Weisman. [1953?] 28p. (BNL-1654)

The circumferential, or angular, variation of the film coefficient was determined for individual Ni tubes at various locations in a 200-tube bank, with water flowing at 360°F and Reynolds numbers in the range 28,000 to 1,200,000. The absolute variation of the coefficient increased with flow rate. However, throughout most of the range of Reynolds numbers investigated, the maximum deviation of the coefficient from the average, for a given tube, was found to be about 15 to 20%. Results are given for Reynolds numbers around, greater than, and less than 5×10^5. Because of the relatively small variation of the coefficient around the tube circumference, temperature variation was also small, and circumferential heat flow negligible. (cf. BNL-1518) (auth)

2405

Institute of Engineering Research, Univ. of Calif., Berkeley

FLUID FLOW AND HEAT TRANSFER AT LOW PRESSURES AND TEMPERATURES. CONVECTIVE HEAT TRANSFER TO SPHERES IN A FREE-MOLECULE FLOW. F. M. Sauer. Jan. 29, 1951. 13p. (HE-150-77)

2406

Massachusetts Inst. of Tech.

BOILING HEAT TRANSFER PROJECT. PROGRESS REPORT [FOR] DECEMBER 1953. Joseph B. Walsh. Jan. 1, 1954. 3p. Contract N5-ori-07827. (NP-5063)

Progress is reported on the visual-density and burnout programs. Reasons for failures in each of the programs are enumerated. No specific data are given. (J.A.G.)

2407

PHENOMENA ACCOMPANYING THE SIMULTANEOUS FLOW OF GASES AND LIQUIDS THROUGH A PIPE-LINE. A. J. Ter Linden. Translated by H. A. Schmitt from Ingenieur (Utrecht) 54, 25-9(1939). 9p. (AEC-tr-1783)

Under certain circumstances, the current in a pipe with a rough surface seems to flow more easily and rapidly than in a smooth pipe. In the transition from a current condition with negative friction to one with a positive friction, a current is observed in which the friction will equal zero, i.e., the average velocity of the liquid along the wall of the tube has no component in the direction of the current. In tubes placed at an angle, relative velocity of gas in relation to liquid appears to be greater than in vertical tubes. (J.E.D.)

2408

FLOW OF A VISCO-PLASTIC DISPERSION SYSTEM IN A CONICAL DIFFUSER. N. V. Tyabin and M. A. Pudovkin. Translated from Doklady Akad. Nauk S.S.S.R. 92, 53-6(1953). 5p. (NSF-tr-209)

MATERIALS TESTING

2409

Hanford Works

BENDING OF GBF GRAPHITE BAR UNDER LOAD. R. C. Lloyd. May 15, 1953. 12p. [Contract W-31-109-eng-52]. (HW-28061)

Bend tests on GBF graphite bars ($4\frac{3}{16}$ in. × $4\frac{3}{16}$ in. and 2 in. × $4\frac{3}{16}$ in.) indicate that the bars can withstand very great loads in comparison to their weight. A deflection of only 150 mils was obtained when 2405 lb was placed on the larger bar having fulcra 2 in. from the ends. The graphite bar took a permanent bend, which was linear with respect to load, on the initial loading after the load reached a critical value. A second loading showed that the bar had elastic characteristics beyond this critical point and over the range of the initial loading. The amount of deflection of the smaller bar was about 8 times that for the larger one under like conditions of loading and fulcra placement. (J.A.G.)

*2410

Columbia Univ.

PRELIMINARY INVESTIGATION OF "ANTI-WHIRL" BEARINGS FOR OPERATION IN AN ACIDIC SOLUTION CONTAINING ABRASIVE PARTICLES. Carl F. Kayan, Gilbert F. Boeker, Dudley D. Fuller, Robert Corry, Beno Sternlicht, and Peter Tea. Dec. 15, 1953. 76p. Contract AT(30-1)-1274. (NYO-3737)

The design and performance of whirl testing equipment used to measure friction torque in test bearings when operating without load and to test the ability of the bearings and the bearing materials to resist abrasion and wear when operating with a load are described. A summary is presented of work done while investigating permissible tolerances in journal bearings using the whirl testing equipment. Data are included from hydrodynamic tests on journal bearings operating with a highly acidic solution containing a heavy salt, investigations of the performance of bearing materials and bearing types when operating under load in water containing a specified amount and size of abrasive material in suspension, and investigations of bearing performance when particles of abrasive diameters greater than the minimum running film thickness in the bearings were eliminated. Development is reported of a simple form of centrifuge to be operated as an integral unit with the shaft and bearing. (C.H.)

*2411

Oak Ridge National Lab.

THE NATURE OF THE FLOW OF ORDINARY FLUIDS IN A THERMAL CONVECTION HARP. D. C. Hamilton, F. E. Lynch, and L. D. Palmer. Mar. 16, 1954. 71p. Contract 7405-Eng-26. (ORNL-1624)

Experiments were conducted to obtain information on the nature of the flow and heat transfer of ordinary fluids in a thermal convection harp. In addition, the mean flow rate,

or Reynolds modulus, was predicted for each of the experiments by use of the wall temperature data and a numerical solution of the laminar flow heat conduction equation. The harp used in this experiment was a loop consisting of four interconnected straight pieces of tubing, two of which were vertical and two of which were essentially horizontal. Heat was added to one of the vertical legs and removed from the other; the two horizontal legs were maintained essentially adiabatic. Tap water was used as the primary fluid. Velocity profiles were obtained from observations of suspended particles in the water. Specially designed thermocouple probes permitted measurement of the wall and fluid temperatures. The investigation revealed that, on the basis of the velocity structure, the heat transfer rate, and the flow regime, the flow and heat transfer of ordinary fluids in a thermal convection harp having adiabatic horizontal legs is more nearly characteristic of free convection than of forced convection. Above the critical value of the Grashof modulus, which was about 10^5, the flow deviated markedly from the laminar structure. The corresponding value of the Reynolds modulus was about 100. The predicted and measured values of the Reynolds modulus agreed to within 30% where the flow was laminar. Above the critical value of the Grashof modulus, where the flow was transitional or turbulent, the method was not applicable and the agreement was unsatisfactory. (auth)

VACUUM SYSTEMS

2412

Atomic Energy Research Establishment, Harwell, Berks (England)

A DESIGN OF PRESSURE/VACUUM VALVE. F. L. Speed. June 1953. 4p. (AERE-ED/R-1302)

This paper presents a design of a pressure/vacuum isolation valve which has operated very satisfactorily in the inert gas lines of experimental liquid metal circuits. Sealing of the seat and gland is achieved by sliding "O" rings resulting in a compact simple construction which requires little maintenance and no gland packing adjustment. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

2413

Research Foundation, Ohio State Univ.

EXPLORATORY STUDY OF THE METAL BONDING OF ALUMINUM TITANATE AND OF MULLITE. Margaret Pausewang. Mar. 1953. 10p. Contract AF-33(616)-3. (WADC-TR-53-145; AD-13776)

An exploratory study of the metal bonding of Al titanate and Al silicate with Fe, Cr, Co, and Ni as binders is reported. Results are reported on wetting, absorption, cold and hot modulus of rupture, and thermal shock tests. Methods for preparation and sintering of the cermets are described. (J.A.G.)

2414

THERMAL CONDUCTIVITY: I. CONCEPTS OF MEASUREMENT AND FACTORS AFFECTING THERMAL CONDUCTIVITY OF CERAMIC MATERIALS. W. D. Kingery and M. C. McQuarrie (Mass. Inst. of Tech., Cambridge). J. Am. Ceram. Soc. 37, 67-72(1954) Feb.

The laws of heat flow and methods of measuring thermal conductivity are considered. The effects of crystalline nature, impurities, lattice imperfections, grain boundaries, porosity, mixtures, and temperature on thermal conductivity are discussed. There are insufficient reliable data to assess quantitatively the effect of most of these factors at present, particularly for elevated temperatures. (auth)

2415

THERMAL CONDUCTIVITY: II. DEVELOPMENT OF A THERMAL CONDUCTIVITY EXPRESSION FOR THE SPECIAL CASE OF PROLATE SPHEROIDS. Milton Adams and A. L. Loeb. J. Am. Ceram. Soc. 37, 73-4(1954) Feb.

A straightforward derivation of the heat-flow equation for a prolate spheroid is given. In its simplest form the expression is thermal conductivity equals body factor (determined for the prolate spheroidal vessel) times power divided by temperature drop. The geometry of the prolate spheroid is reflected in a detailed expression for the body factor. (auth)

2416

THERMAL CONDUCTIVITY: III. PROLATE SPHEROIDAL ENVELOPE METHOD (Data for Al_2O_3, BeO, MgO, ThO_2, and ZrO_2). Milton Adams. J. Am. Ceram. Soc. 37, 74-9 (1954) Feb.

An absolute method of determining the thermal conductivity of refractory materials is described. This investigation confines itself to the steady state, i.e., where the temperature at any given point in the material is independent of time. The variation of conductivity with temperature is shown for alumina, magnesia, zirconia, beryllia, thoria, and insulating firebrick B & W K-28. The results of previous studies are compared with those of this investigation. (auth)

2417

THERMAL CONDUCTIVITY: IV. APPARATUS FOR DETERMINING THERMAL CONDUCTIVITY BY A COMPARATIVE METHOD (Data for Pb, Al_2O_3, BeO, and MgO). J. Francl and W. D. Kingery. J. Am. Ceram. Soc. 37, 80-4(1954) Feb.

Apparatus for determing thermal conductivity by a comparative method of steady-state heat flow through 1-in.-cube samples is described. Suitable precautions insure linear heat flow and low heat losses. Measurements with melting-point Pb give values in good agreement with previous data. Measurements for dense Al_2O_3, BeO, and MgO indicate a conductivity which decreases with temperatures from values at 100°C of 0.50 cal/sec/°C/cm^2/cm for BeO, 0.081 for MgO, and 0.067 for Al_2O_3. Values obtained are somewhat higher than most of those previously reported. (auth)

2418

THERMAL CONDUCTIVITY: V. HIGH-TEMPERATURE METHOD AND RESULTS FOR ALUMINA, MAGNESIA, AND BERYLLIA FROM 1000° TO 1800°C. Malcolm McQuarrie. J. Am. Ceram. Soc. 37, 84-8(1954) Feb.

A method of measuring the thermal conductivity of refractory oxides at high temperatures is described. Heat is generated inductively in a metal susceptor inside a hollow specimen in the shape of a prolate spheroid, the temperature of which is measured at two points by means of an optical pyrometer. The conductivities of alumina, magnesia, and beryllia were measured between 1000 and 1800°C. (auth)

2419

THERMAL CONDUCTIVITY: VI. DETERMINATION OF CONDUCTIVITY OF Al_2O_3 BY SPHERICAL ENVELOPE AND CYLINDER METHODS. W. D. Kingery. J. Am. Ceram. Soc. 37, 88-90(1954) Feb.

Values of the thermal conductivity of Al_2O_3 have been determined by methods employing a spherical envelope specimen completely surrounding a heat source and a long

hollow cylinder in which a center section is employed for a test zone. Values obtained are in close agreement with values previously determined by other methods. (auth)

2420

THERMAL CONDUCTIVITY: VII. ANALYSIS OF VARIATION OF CONDUCTIVITY WITH TEMPERATURE FOR Al_2O_3, BeO, AND MgO. Malcolm McQuarrie. J. Am. Ceram. Soc. 37, 91-5(1954) Feb.

The results of previously published investigations into the thermal conductivities of alumina, magnesia, and beryllia by five different methods in different temperature ranges are summarized in the empirical equation $k = A/(T - 125) + 8.5 \times 10^{-36}T^{10}$, where A = 16.2 for alumina, 18.8 for magnesia, and 55.4 for beryllia; the equation is valid (within about 10%) from room temperature to 1800°C for alumina and magnesia and from 1000 to 1800°C for beryllia. The departure from the reciprocal temperature law at the higher temperatures (represented by the second term in the equation) is believed to be due to an increase in the apparent conductivity by the passage of radiant energy through the translucent specimens. (auth)

CORROSION

2421

Metallurgical Lab., Engineering Experiment Station, Annapolis

PERFORMANCE OF MATERIALS TESTED IN WATER AT HIGH TEMPERATURE. W. G. Schreitz and C. J. Lancaster. Sept. 14, 1951. 32p. (EES-4A(14)966870)

Results of corrosion and stress-corrosion tests are reported for specimens tested in a dynamic-corrosion apparatus and in a hydraulic circuit. A 30-day test run was made in the dynamic-corrosion tester, during which time the samples were under a static bending stress. Twelve materials were tested at a peripheral velocity of 11 fps in oxygenated water at 500°F. Following the test, the specimens were weighed and then pulled in tension. Tension-test results are also reported for a set of control specimens. Stress-corrosion tests were made of 6 materials in the hydraulic loop. Cylindrical tension specimens were spring loaded to 0.25 of the tensile strength while under test in the circuit. The test was conducted in degassed water at 600°F at a velocity of 25 fps for 34 days. Evaluation was based on weight change and tensile properties as compared with results obtained for control specimens. Results of weight change are also reported for flat tension specimens of 16 materials which were tested in the hydraulic loop without applied stress. This test was made in 500°F oxygenated water at 10 fps. Experiments to determine procedures for controlling the O_2 content of the water, particularly in the pressure vessel of the dynamic tester, are described. (auth)

GEOLOGY AND MINERALOGY

2422

Pennsylvania State Univ.

AN INVESTIGATION OF THE CHEMICAL NATURE OF THE ORGANIC MATTER OF URANIFEROUS SHALES. QUARTERLY PROGRESS REPORT [FOR] OCTOBER 1 TO DECEMBER 31, 1953. Donald Schwartz, W. V. Curran, and C. R. Kinney. Dec. 31, 1953. 11p. Contract AT(30-1)-1442. (NYO-6087)

Results of analysis and β-γ counts of the products of air oxidation of Chattanooga shale at 200 and 225°C are tabulated. Particle size does not appear to have much effect on the extent of oxidation. The reaction rate of ozonization and percentage yields from ozonization are tabulated. (cf. NYO-6086) (J.S.R.)

2423

Grand Junction Operations Office, AEC

GEOLOGY OF THE URANIUM DEPOSITS OF THE LUKACHUKAI MOUNTAINS AREA NORTHEASTERN ARIZONA. John A. Masters. June 11, 1953. 23p. (RME-27)

A concentration of ore bodies occurs in a belt across the Lukachukai Mountains. The ore belt conforms to a facies of lenticular sandstone and mudstone which provided sufficient permeable sandstone for the passage of ore solutions and sufficient impermeable mudstone to canalize the flow of solutions into particular sandstone beds. An unusual concentration of carbon served as a precipitation agent. Lateral changes in permeability of the sandstone beds, related to the old stream systems, influenced the movement of mineralizing solutions. The moving solutions apparently bleached red sandstones to gray or to limonitic brown. Mapping of drill core data shows that ore bodies are elongate parallel to sedimentation, ore bodies tend to occur along the flanks of sandstone channels which are bounded laterally by zones of "flood-plain" lithology, ore bodies often occur in groups, ore bodies tend to "build up" against permeability barriers. With this knowledge, areas can be evaluated by relatively wide-spaced drill holes in which sedimentation trends and lithologic changes are mapped. The degree of mineralization in an area is related to the initial quantity and quality of ore solutions, carbon, and permeability variations. Permeability changes probably do not directly cause precipitation, but are effective in the formation of large deposits. (auth)

2424

Grand Junction Operations Office, AEC

APPLICATIONS OF CROSS STRATIFICATION STUDIES TO PROBLEMS OF URANIUM EXPLORATION. James D. Lowell. Aug. 1953. 17p. (RME-44)

Ancient stream directions in the lower Morrison formation of the Chuska Mountains were reconstructed through use of cross-stratification mapping techniques. Dip directions of the cross-strata, when combined in the forms of histograms and vector resultants, allowed projection, in the direction of paleostream flow, of uranium ore bodies and bleached zones which surround them. The ore bodies are elongated in the direction of ancient current flow. A plotting of the sedimentation structures defined intersections of ancient stream systems, and these localities appeared to be favorable loci for the deposition of uranium ore. A possible relation between type of stratification and location of uranium ore bodies is described. (auth)

2425

Grand Junction Operations Office, AEC

RECONNAISSANCE OF THE URANIUM DEPOSITS OF THE LOCKHART CANYON—INDIAN CREEK AREA, SAN JUAN COUNTY, UTAH. George P. Dix, Jr. May 15, 1953. 20p. (RME-4038)

Copper–uranium mineralization in the Bogus Tongue member of the Cutler formation in the Lockhart Canyon–Indian Creek area is probably one of the initial uranium discoveries in the Cutler formation on the Colorado Plateau. The deposits were found by an airborne survey. Mineralization occurs in discontinuous lenses of arkose that outcrop intermittently from the mouth of Hart Draw in Indian Creek to the confluence of Cane Creek and the Colorado River. The mineralized arkoses occur at various stratigraphic levels in the Bogus Tongue of the Cutler formation. The economic importance of the deposits is somewhat curtailed by the rough terrain and lack of access roads. (auth)

2426
Geological Survey
RECONNAISSANCE FOR URANIFEROUS ROCKS IN NORTHWESTERN COLORADO, SOUTHWESTERN WYOMING, AND NORTHEASTERN UTAH. E. P. Beroni and F. A. McKeown. July 1952. 41p., 1 illus. (TEI-308A)

Previous discoveries and studies of radioactive lignites of Tertiary age in North Dakota, South Dakota, Montana, and Wyoming led the Geological Survey in 1950 to do reconnaissance in the Green River and Uinta Basin of Wyoming and Utah, where similar lignites were believed to be present. Because of the common association of uranium with copper deposits and the presence of such deposits in the Uinta Basin, several areas containing copper-uranium minerals were also examined. No deposits commercially exploitable under present conditions were found. Samples of coal from the Bear River formation at Sage, Wyo., assayed 0.004 to 0.013% uranium in the ash; in the old Uteland copper mine in Uintah County, Utah, 0.007 to 0.017% uranium; in a freshwater limestone, Duchesne County, Utah, as much as 0.019% uranium; and in the Mesaverde formation at the Snow and Bonniebell claims near Jensen, Uintah County, Utah, 0.003 to 0.090% uranium. Maps were made and samples were taken at the Skull Creek carnotite deposits in Moffat County, Colo. (0.006 to 0.16% uranium); at the Fair-U claims in Routt County, Colo. (0.002 to 0.040% uranium); and at the Lucky Strike claims near Kremmling in Grand County, Colo. (0.006 to 0.018% uranium). (auth)

2427
Geological Survey
RECONNAISSANCE FOR RADIOACTIVE MATERIALS IN NORTHEASTERN UNITED STATES DURING 1952. Francis A. McKeown and Harry Klemic. June 1953. 66p. (TEI-317-A)

Reconnaissance for radioactive materials was made in parts of Maine, New York, New Jersey, and Pennsylvania. The primary objective was to examine the iron ore deposits and associated rocks in the Adirondack Mountains of New York and the Highlands of New Jersey. In addition, several deposits known or reported to contain radioactive minerals were examined to delimit their extent. Most of the deposits examined are not significant as possible sources of radioactive elements and the data pertaining to them are summarized in table form. (auth)

2428
BERYLLIUM RESOURCES OF THE TIN-SPODUMENE BELT, NORTH CAROLINA. W. R. Griffitts (Geological Survey, Washington). Geological Survey Circular 309, 1954. 15p.

Pegmatite dikes in the tin-spodumene belt of North and South Carolina uniformly contain about 0.05 percent BeO. The most abundant minerals in the pegmatite contain from 0.0001 to 0.01 percent BeO. Beryl, having 12.0 to 12.3 percent BeO, is the only beryllium-rich mineral and contains more than 80 percent of the total beryllium in the rock. Beryl-bearing pegmatite crops out on hillsides near streams that flow through the pegmatite belt. Much of the pegmatite contains spodumene, feldspar, mica, cassiterite, and columbite, as well as beryl, but separating these minerals will require milling. The minable spodumene ore in the Kings Mountain area, above a depth of 300 feet, contains about 40,000 tons of beryl, equivalent to 6,000 tons of BeO, if 80 percent of the BeO is assumed to be in beryl. Other pegmatite in that area contains an additional 238,000 tons of beryl, or 35,900 tons of BeO. On the basis of the same assumptions the spodumene ore above a depth of 300 feet in the Beaverdam Creek area contains 6,000 tons of beryl, or 800 tons of BeO, and all other pegmatite in that area contains an additional 13,000 tons of beryl, or 1,700 tons of BeO. The entire tin-spodumene belt contains 823,000 tons of beryl, equivalent to 122,800 tons of BeO. Little beryllium was found in the Piedmont province outside of the tin-spodumene belt.

2429
THE EAST SLOPE NO. 2 URANIUM PROSPECT, PIUTE COUNTY, UTAH. Donald G. Wyant. Geological Survey Circular No. 322, 1954. 7p.

The secondary uranium minerals autunite, metatorbernite, uranophane(?), and schroeckingerite occur in altered hornfels at the East Slope No. 2 U prospect. Hornfels, formed by contact metamorphism of rocks of the Bullion Canyon volcanics bordering the margin of a quartz monzonite stock, is in fault contact with the later Mount Belknap rhyolite. The hornfels was intensely altered by hydrothermal solutions in pre-Mount Belknap time. Hematite-alunite-quartz-kaolinite rock, the most completely altered hornfels, is surrounded by orange to white argillized hornfels containing beidellite-montmorillonite clay, and secondary U minerals. The secondary U minerals probably have been derived from pitchblende, the primary ore mineral in other deposits of the Marysvale area. The two U-rich zones, 4 ft and 5 ft thick, have been traced on the surface for 60 ft and 110 ft, respectively. Channel samples from these zones contained as much as 0.047% U. The deposit is significant because of its position outside the central producing area and because of the association of U minerals with alunitic rock in hydrothermally altered hornfels of volcanic rocks of early Tertiary age. (auth)

METALS AND METALLURGY

2430
Knolls Atomic Power Lab.
A MODEL FOR RADIATION DAMAGED DUCTILE METALS. A. N. Holden and F. W. Kunz. June 10, 1953. Decl. with deletions Jan. 29, 1954. 24p. Contract W-31-109-Eng-52. (AECD-3616; KAPL-929)

A model is presented for radiation damage to ductile metals that accounts qualitatively for the effects of radiation on the electrical and mechanical properties. The model consists of an agglomeration of interstitially displaced atoms into stacking faults in the lattice. (auth)

*2431
Battelle Memorial Inst.
THE STRENGTH OF WROUGHT ZIRCONIUM-BASE BINARY ALLOYS AT 1800 TO 2200 F. H. A. Saller, J. T. Stacy, and S. W. Porembka. Feb. 17, 1954. 22p. Contract W-7405-Eng-92. (BMI-903)

The effects of a number of elements on the workability, hardness, and high-temperature strength of zirconium were investigated. Binary alloys of zirconium with chromium, columbium, molybdenum, tantalum, tungsten, and vanadium were surveyed. A short-time stress-rupture apparatus was constructed to determine strengths in a neutral atmosphere at 1800 to 2200°F. Alloys of tantalum or tungsten were the most easily worked, and those containing chromium or vanadium were the most difficult to work. At 1600°F, maximum hardness was obtained with a tungsten addition. Tungsten also appears to be the most effective strengthener for zirconium at 1800 to 2200°F; a zirconium–8 wt. % tungsten alloy had a 100-hr creep-rupture strength of 1700 psi at 1800°F. None of the alloys studied were superior in strength to Inconel or Type 310 stainless steel over the range 1800 to 2200°F. (auth)

*2432
Battelle Memorial Inst.
A METHOD OF MEASURING THE CONTRIBUTION OF CRYSTAL STRUCTURE TO THE HARDNESS OF METALS.

W. Chubb. [1953]. Decl. Mar. 9, 1954. 21p. Contract W-7405-eng-92. (BMI-X-112)

Hardness measurements of metals at temperatures just above and just below their allotropic change point has established that crystal structure has a real effect upon the strength of metals. The contribution of crystal structure to strength has been evaluated. For thallium, titanium, and zirconium, a transformation from a hexagonal close-packed structure to a body-centered cubic structure produces a threefold decrease in hardness (DPH). The transformation in Fe from face-centered cubic γ to body-centered cubic α results in a similar decrease in hardness (DPH). The transformation in cobalt from hexagonal close-packed to face-centered cubic produces an almost insignificant increase in hardness (DPH). The transformation of uranium from complex tetragonal to body-centered cubic results in more than a 20 to 1 loss in hardness (DPH). (auth)

*2433

Knolls Atomic Power Lab.

MECHANICAL PROPERTIES OF BERYLLIUM. (SUB-PROJECT NO. 4). E. E. Baldwin and R. F. Koenig. Feb. 15, 1954. 65p. Contract W-31-109-eng-52. (KAPL-1049)

An investigation was carried out to determine the mechanical properties of beryllium produced by various fabrication techniques and the effects of testing and fabrication variables on these mechanical properties. To realize maximum mechanical properties, machined beryllium must be annealed and the disturbed surface metal removed by etching. Tests showed that of all the materials tested, hot-pressed, hot-extruded beryllium exhibited the highest strength and ductility. However, these properties were exhibited only in a direction parallel to the extrusion axis and were influenced by the size of the powder from which the extrusion billet was made. It was also found that all beryllium was notch sensitive, notches reducing the ductility by a factor of 4 at room temperature and by a factor of 2 at 1000°F (538°C). (auth)

*2434

North American Aviation, Inc.

EFFECT OF COLD WORK ON THE MAGNETIC SUSCEPTIBILITY OF COPPER AND ALUMINUM. J. D. McClelland. Mar. 15, 1954. 11p. Contract AT-11-1-GEN-8. (NAA-SR-861)

The susceptibilities of copper and aluminum have been measured as a function of cold work. Spectroscopically pure samples were cold worked both by rolling and compression. A Faraday method was used to determine the specific susceptibility and the mass concentration of the ferromagnetic contaminant simultaneously. No changes were noted in either metal. It is pointed out that trace amounts of ferromagnetic impurity accidentally picked up during the cold-working process would result in large apparent changes in the observed susceptibility. (auth)

2435

Lewis Flight Propulsion Lab., NACA

THERMAL CONDUCTIVITY OF 14 METALS AND ALLOYS UP TO 1100°F. Jerry E. Evans, Jr. Mar. 2, 1951. 15p. (NACA-RM-E50L07)

2436

Battelle Memorial Inst.

FURTHER STUDIES OF THE MECHANISM BY WHICH HYDROGEN ENTERS METALS DURING CHEMICAL AND ELECTROCHEMICAL PROCESSING. L. D. McGraw, W. E. Ditmars, C. A. Snavely, and C. L. Faust. Mar. 1954. 37p. (NACA-TN-3164)

This investigation was a continuation of efforts to develop fundamental concepts which would be useful in preventing or alleviating hydrogen damage to steel. NACA Technical Note 2696 presented a new mechanism which postulates that the entry of hydrogen into metals from chemical and electrochemical action occurs when hydrogen-metal alloy formation is simultaneous with discharge (or release) of hydrogen atoms. In the present work the phenomena relating to hydrogen entry into steel were studied further. In general, the results support the newly postulated concepts. (NACA)

2437

Chemical Research Lab., Metal Hydrides, Inc.

PROGRESS REPORT NUMBER 10, CONTRACT SC-2026 TO NEPA DIVISION, FAIRCHILD ENGINE AND AIRPLANE CORPORATION. PERIOD COVERED: MAY 16–JUNE 15, 1949. Thomas R. P. Gibb, Jr. June 25, 1949. 13p. Contract [W-33-08-ac-14801(16250)], Subcontract 2026. (NEPA-1060)

The preparation and dissociation of TiH_2 and WH_2 are studied, together with the H diffusion rate in stainless steel. (K.S.)

2438

Battelle Memorial Inst.

SURFACE HARDENING OF TITANIUM BY CARBURIZING AND INDUCTION HEAT TREATMENT. FINAL TECHNICAL REPORT COVERING THE PERIOD SEPTEMBER 1, 1952 TO AUGUST 31, 1953. P. E. Moorhead, A. J. Griest, P. D. Frost, and J. H. Jackson. Aug. 31, 1953. 35p. Contract DA-33-019-ORD-942. (NP-5074)

Progress is reported on the gas carburizing of Ti and Ti alloys with C_3H_8–A mixtures at temperatures of 1450, 1600, 1750, and 1850°F. A metallographic determination of the characteristics of the case formed was made. The effects of alloy composition, temperature, propane concentration, flow rate, and prior treatments of surface in a phosphate-fluoride bath are discussed. Results of bend and wear tests are given. The amount of H_2 absorption during carburizing with hydrocarbons was determined. Similar results are reported for the gas carburizing of Ti and Ti alloys with CH_4–A, C_2H_6–A, and CO–A mixtures. Surface treatments to improve wear resistance by nitriding, electrofilm "Lube-Lok" coatings, and vapor-phase deposition of TiC are discussed. (For preceding period see NP-4929.) (J.A.G.)

2439

Battelle Memorial Inst.

THE EFFECT OF MICROSTRUCTURE ON THE MECHANICAL PROPERTIES OF TITANIUM ALLOYS. SUMMARY REPORT [COVERING THE PERIOD FROM JUNE 18, 1951 THROUGH DECEMBER 31, 1953]. F. C. Holden, H. R. Ogden, and R. I. Jaffee. Dec. 31, 1953. 39p. Contract DA-33-019-ORD-280. (NP-5075)

Brief summaries are presented of various phases of work conducted in a systematic investigation of the microstructure, heat treatment, and mechanical properties of titanium alloys prepared with high-purity iodide titanium. The mechanical properties of high-purity titanium and α alloys containing interstitial or substitutional α solutes are relatively unaffected by microstructural changes, grain size, and grain shape. Strengths may be increased by solid-solution strengthening, and, except for the Ti-C alloys, which are influenced by the quantity of carbon in solid solution, the α alloys are not heat treatable. The interstitial elements in solid solution have a detrimental effect on the notch toughness of titanium while the substitutional alpha solute, aluminum, does not cause notch embrittlement. The α-β alloys are susceptible to heat treatment, and considerable mechanical-property variation can be obtained by altering the α-β ratio in the structure, by the formation of martensite when the alloys are quenched from the β field, or by precipitation of coherent α from the β. Low-temperature aging or controlled cooling rates from high annealing temperatures can be used effectively to increase the strength of β-stabilized alloys. The Ti–Cu alloys are

quench hardenable and have been found to be similar to steels in their response to heat treatment and microstructure variations. (For preceding period see NP-5004.) (auth)

2440

Climax Molybdenum Co. of Mich.

FOURTH ANNUAL REPORT [ON] ARC-CAST MOLYBDENUM BASE ALLOYS. M. Semchyshen and R. Q. Barr. 1953. 316p. Contract N8onr-78700. (NP-5079)

Mechanical properties at room and elevated temperatures of wrought arc-cast Mo-base alloys and deoxidation and forging practices are reported. Elimination of the embrittlement of wrought Mo upon exposure to temperature above 2000°F and preliminary appraisal of ternary Mo-base alloys, through metallographic examination, measurement of hardness at room and elevated temperatures, and the measurement of lattice parameters are discussed. (For preceding period see NP-4277.) (J.E.D.)

2441

National Research Corp.

THE IMPROVEMENT OF FORGEABLE HEAT-RESISTANT ALLOYS BY VACUUM TECHNIQUES. James H. Moore. Oct. 20, 1952. 81p. Contract AF 33(038)-22382, Final Report. (NP-5082)

2442

Iowa Engineering Experiment Station

THERMAL CONDUCTIVITY OF MOLTEN MATERIALS. PROGRESS REPORT NO. 1 [FOR] QUARTER ENDING MARCH 31, 1952. Apr. 3, 1952. 6p. Contract AF 33(616)-11. (NP-5093)

2443

Engineering Research Inst., Univ. of Mich.

DEVELOPMENT OF PROCEDURES FOR THE IDENTIFICATION OF MINOR PHASES IN HEAT-RESISTANT ALLOYS BY ELECTRON DIFFRACTION. ANNUAL SUMMARY REPORT [FOR] JANUARY 15, 1952 TO JANUARY 15, 1953. L. O. Brockway and W. C. Bigelow. May 1953. 30p. Contract AF-33(616)-23. (NP-5096)

A summary of the work completed on this project during the first contract year is presented. An extensive investigation has been made of the influence of high-temperature aging on the minor phases of 16-25-6 alloy, and preliminary studies have been made of S816 and low-carbon N-155 alloys. A considerable amount of information has been obtained on the techniques of preparing heat-resistant alloy samples for the electron-diffraction studies. This report is devoted principally to the discussion of these techniques because sample preparation is the most important and the most difficult part of the adaptation of the electron-diffraction method to the heat-resistant alloys and also because this material has not been organized and presented previously. The results of the studies of the S816, N-155, and 16-25-6 alloys are described only briefly, inasmuch as they were presented in detail in the preceding quarterly reports. (auth)

2444

Engineering Research Inst., Univ. of Mich.

DEVELOPMENT OF PROCEDURES FOR THE IDENTIFICATION QF MINOR PHASES IN HEAT-RESISTANT ALLOYS BY ELECTRON DIFFRACTION. PROGRESS REPORT NO. 5 FOR THE PERIOD JANUARY 15 TO APRIL 15, 1953. L. O. Brockway and W. C. Bigelow. 16p. Contract AF-33(616)-23. (NP-5097)

The electron-diffraction method has been applied to the study of Alcoa M-276 Sintered Aluminum Product and γ-Al_2O_3 has been identified as the principal minor phase in this material. A special etching procedure using HCl and Cl_2 gases was developed for this work to minimize the oxidation of the aluminum during preparation. A number of polishing and etching treatments have been investigated for suitability in preparation of Inconel-X alloy for the electron-diffraction studies. Polishing methods which appear to be satisfactory have been found. Difficulty has been encountered in etching this alloy due to the formation of reaction products on the samples during the etching process. Data have been obtained which indicate a variation of about 1% in the unit cell size of the M_6C phase of the 16-25-6 alloy, depending on the temperature of the aging treatment. (auth)

2445

Engineering Research Inst., Univ. of Mich.

DEVELOPMENT OF PROCEDURES FOR THE IDENTIFICATION OF MINOR PHASES IN HEAT-RESISTANT ALLOYS BY ELECTRON DIFFRACTION. PROGRESS REPORT NO. 7 FOR THE PERIOD JULY 15 TO OCTOBER 15, 1953. L. O. Brockway and W. C. Bigelow. 30p. Contract AF-33(616)-23. (NP-5098)

Using the electron-diffraction method, minor phases have been identified in samples of Inconel-X alloy representing aging treatments of 100 and 1000 hours at 1400°F and 10, 100, and 1000 hours at 1600°F. Nb carbonitride and $M_{23}C_6$-type carbide have been identified in each of the samples aged at 1400°F; however, only the columbium carbonitride has been identified in the samples aged at 1600°F. These results suggest a strong influence of aging temperature on minor-phase formation; the investigation is therefore being extended to include samples aged at 1200°F. Studies have been made of the minor phases of low-carbon N-155 alloy using samples aged 10, 100, and 1000 hours at 1400°F and 10 and 1000 hours at 1600°F. Patterns corresponding closely to an intermetallic compound, Fe_2W, have been obtained from the samples aged 1000 hours at 1400 and 1600°F. Nb carbonitride and an $M_{23}C_6$ carbide have been identified in the samples aged 10 and 100 hours at 1400°F. These results are discussed in terms of the prior heat treatment of the samples. Mechanical polishing procedures were used instead of the usual electrolytic polishing in preparing the N-155 alloy samples for the electron-diffraction examination. The results indicate that satisfactory surface preparations may be obtained in this manner and are discussed in terms of the possible advantages and disadvantages of using mechanical polishing. In addition, positive- and negative-plastic-replica techniques have been compared to determine the most convenient replica methods for obtaining electron micrographs for use in connection with the electron diffraction studies. Carbides have been separated from several samples of 16-25-6 alloy and examined by x-ray diffraction to compare the results obtained by the electron-diffraction and x-ray-diffraction methods of minor-phase identification. (auth)

*2446

Columbia Univ. School of Mines

THE STUDY OF DIFFUSIONLESS PHASE CHANGES IN SOLID METALS AND ALLOYS. PROGRESS REPORT FOR THE PERIOD JUNE 1 TO AUGUST 31, 1953. T. A. Read, D. S. Lieberman, M. S. Wechsler, and C. W. Chen. Jan. 1954. 4p. Contract AT-(30-1)-904. (NYO-3963; CU-15-53-AEC-904-Met.)

A method of calculating the direction of shear for the austenite-martensite transformation is presented. The diffusionless transformation of 50-50 at. % Cd–Au alloy was studied. Calculation of the direction of shear and a brief description of the austenite-martensite transformation are given. (For preceding period see NYO-3961.) (J.E.D.)

2447

Pittsburgh Univ.

APPLICATION OF CHEMICAL THERMODYNAMICS TO THE STUDY OF ALLOY FORMATION. PROGRESS REPORT FOR OCTOBER 1, 1953 TO JANUARY 1, 1954.

W. E. Wallace, R. S. Craig, T. D. Brotherton, W. V. Johnston, S. Kamath, and C. A. Krier. Jan. 5,1954. 6p. Contract AT-(30-1)-647. (NYO-6165)

Equipment for measuring specific heats of K and Na_2K between 10 and 325°K was completed. Calibration measurements from 200 to 325°K are also complete but not calculated. The sample container for specific heat measurements from 25 to 300°C has been entirely rebuilt. It is now ready for calibration. Facilities are being readied for studying the anomalous behavior in Mg–Cd alloys between 200 and 300°K. (For preceding period see NYO-6154.) (auth)

2448

Massachusetts Inst. of Tech.

THERMODYNAMICS OF METAL SOLUTIONS. THERMODYNAMICS OF THE LIQUIDUS AND SOLIDUS OF BINARY ALLOYS. Carl Wagner. Nov. 2, 1953. 26p. Contract AT(30-1)-1002. Scope I. (NYO-7004)

For alloys completely miscible in the liquid and the solid state, formulas are derived in order to calculate from the phase diagram the difference in the excess integral molar-free energies of the solid and the liquid phase, which is essentially equal to the strain energy due to the difference in size of the constituent atoms. The width of the gap between the liquidus and the solidus in the system Ag–Au is calculated to be 1.3° at $N_{Au} = 0.5$, in contrast to an experimental value of 10°. The divergence between the calculated and the observed value is due to incomplete attainment of equilibrium during thermal analysis. Formulas for the liquidus and the solidus in the vicinity of a minimum are derived and applied to the system Au–Cu. (auth)

*2449

Massachusetts Inst. of Tech.

X-RAY MEASUREMENTS OF LOCAL ATOMIC ARRANGEMENTS IN Al–Zn AND IN Al–Ag SOLID SOLUTIONS. P. S. Rudman and B. L. Averbach. Dec. 1, 1953. 27p. Contract AT(30-1)-1002, Scope 2, Technical Report No. 19. (NYO-7038)

The x-ray-diffuse scattering from Al–Zn solid solutions has been measured at equilibrium above the solubility temperature. Observations were made for compositions ranging from 5 to 50 at. % Zn at 400°C, and at 300 and 500°C for a 10 at. % Zn alloy. The diffuse scattering exhibits a strong small-angle component, and this has been interpreted in terms of Zn- and Al-rich clusters. The excess of like neighbors does not appear to extend beyond the first shell of atoms, and the average nearest neighbor excess has been measured. The diffuse scattering from an Al–10 at. % Ag solid solution at 540°C has also been measured, and a similar clustering has been observed. The quasi-chemical theory is used to compare the x-ray results with the measured thermodynamic data, and an apparent agreement is obtained. (auth)

*2450

Sylvania Electric Products Inc., Atomic Energy Div.

LUBRICANTS AND FRICTION IN POWDER METALLURGY. I. Sheinhartz, H. M. McCullough, and J. L. Zambrow. Jan. 11, 1954. 12p. Contract AT-30-1-GEN-366. (SEP-142)

A method is described for measuring the total friction developed during the pressing of metal powders, which can be used to evaluate the effectiveness of materials as lubricants. Several materials are shown to be satisfactory die-wall lubricants for cold pressing. The ability of a lubricant to bond itself to the die wall is determined by the particle size and shape, vehicle, and method of application. Mathematical relationships are developed which correlate applied load, transmitted load, weight, length, and die diameter. (J.A.G.)

2451

General Electric Research Lab.

DEVELOPMENT OF ZIRCONIUM-BASE ALLOYS. SEVENTEENTH QUARTERLY REPORT. (PROGRESS REPORT NO. 18). J. H. Keeler. Jan. 5, 1954. 14p. Contract W-31-109-Eng-52. (SO-2513; RL-1036)

Tensile tests were conducted on Zr ternary alloys in air at room temperature and in vacuo at 500°C. Yield-stress and elongation data are presented. A stress-strain curve typical of many Zr binary alloys tested at 500°C is shown. Initial creep data for unalloyed Zr and for a Zr–Al binary alloy are given. Deformation and annealing textures for unalloyed, arc-melted, and cold-rolled Zr are presented, as are annealing textures for two Zr–Al alloys. (For preceding period see SO-2512.) (auth)

2452

New York Univ. Coll. of Engineering

MECHANISM OF MARTENSITIC TRANSFORMATION OF TITANIUM ALLOYS. SUMMARY TECHNICAL REPORT. Y. C. Liu. Nov. 12, 1953. 48p. Contract DA-30-069-ORD-823. (WAL-401/88-28)

2453

New York Univ. Coll. of Engineering

GRAIN SIZE CONTROL IN TITANIUM AND THE EFFECT THEREON OF VARIOUS ADDITION AGENTS. FINAL REPORT. Y. C. Liu. Nov. 30, 1953. 44p. Contract DA-30-069-ORD-840. (WAL-401/105-25)

The effect of 50 alloying elements on beta titanium grain size was studied. An attempt was also made to accelerate the decomposition of the beta phase of titanium. Growth characteristics of beta titanium grains in Ti–15% Mo alloy were investigated. It was observed that no single alloying element used in the present investigation within the composition range studied had the ability to refine beta titanium grain size. A limited number of ternary titanium alloys from four selected elements (boron, carbon, beryllium, and silicon) was also tested. Only one combination of these elements, boron and carbon, could be used as a beta titanium grain refiner. The possibility of accelerating the decomposition of beta titanium grains by alloying with iron, silicon, and oxygen or nitrogen or both is suggested. The growth characteristics of beta titanium grains were studied. The activation energy for grain growth was found to be 57.8 kcal/g-atom. (auth)

2454

CONCERNING THE MANUFACTURE OF FERROVANADIUM AT THE ELECTROMETALLURGICAL SHOP OF THE CHUSOVOY PLANT. A. Yu. Polyakov. Translated from Kachestvennaya Stal 5(1937). (AEC-tr-1787)

2455

RELATION BETWEEN CREEP AND RELAXATION OF STRESSES IN METALS. I. A. Oding, O. V. Sorokin, and N. D. Sazanova. Translated from Doklady Akad. Nauk S.S.S.R. 92, 565-8(1953). 4p. (NSF-tr-152)

Creep and relaxation curves were calculated on the basis of elastic and plastic deformation, time, and stress at a given temperature. Creep and relaxation tests were conducted on samples of Cr–Ni austenitic steel subjected to 3 different processes of heat treatment to verify theoretical results. (J.A.G.)

2456

ON THE THEORY OF MAGNETIC SUSCEPTIBILITY OF THIN LAYERS OF METALS AT LOW TEMPERATURES. I. M. Lifshits and A. M. Kosevich. Translated from Doklady Akad. Nauk S.S.S.R. 91, 795-8(1953). 5p. (NSF-tr-156)

2457

ELECTRON-OPTICAL METHOD FOR IMAGING OBJECTS

WITH MAGNETIC NONHOMOGENEITIES. G. V. Spivak, N. G. Kanavina, I. N. Chernyshev, and I. S. Sbitnikova. Translated from Doklady Akad. Nauk S.S.S.R. 92, 541-3 (1953). 4p. (NSF-tr-202)

2458

EFFECT OF SILICON ON THE RATE OF DIFFUSION OF CARBON IN AUSTENITE. M. A. Krishtal. Translated from Doklady Akad. Nauk S.S.S.R. 92, 951-3(1953). 3p. (NSF-tr-223)

Methods for the determination of diffusion coefficients of C in austenite are reviewed, and a simplified method is proposed. The method is applied to the determination of C distribution in a cast-Fe specimen subjected to decarburization, and data are presented on the coefficient of C diffusion in austenite versus Si content determined at various temperatures. (C.H.)

2459

ON THE STATE OF MARTENSITE CRYSTALS IN QUENCHED LOW-CARBON STEELS. G. V. Kurdyumov, M. D. Perkas, and A. E. [Ye] Shamov. Translated from Doklady Akad. Nauk S.S.S.R. 92, 955-7(1953). 4p. (NSF-tr-224)

In the drastic quenching of 0.1% C steel no disintegration of martensite takes place during cooling, and the carbon is retained in the solid solution. This is also true for steels containing less than 0.1% C. The main condition for retaining the total amount of carbon in the α solid solution is a high rate of cooling, sufficient to prevent a precipitation of ferrite or $\gamma \rightarrow \alpha$ transformation above the martensite point, i.e., the preservation of undecomposed austenite above the temperature range at which the martensite transformation takes place. (auth)

2460

COMPUTATION OF THE RATE OF SOLIDIFICATION OF AN INGOT TAKING INTO ACCOUNT THE TEMPERATURE DEPENDENCE OF THE THERMOPHYSICAL PARAMETERS OF THE METAL. B. Ya. Lyubov. Translated from Doklady Akad. Nauk S.S.S.R. 92, 763-6(1953). 4p. (NSF-tr-227)

In the calculation of the rate of solidification of a metal, it is usually assumed that the thermal conductivity, λ, and the heat capacity, c, are independent of the temperature. As in actuality, the two parameters are temperature dependent, a method is developed which allows for this temperature dependence. The crystallization rate of Al is calculated as an example. (J.S.R.)

2461

THE EFFECT OF IRON, MANGANESE, AND CHROMIUM ON THE PROPERTIES IN SHEET FORM OF ALUMINIUM ALLOYS CONTAINING 0.7% MAGNESIUM AND 1.0% SILICON. R. Chadwick, N. B. Muir, and H. B. Grainger (Imperial Chemical Industries, Ltd., Metals Div., Birmingham, England). J. Inst. Metals 82, 75-80(1953) Oct.

As part of a systematic investigation of alloys hardened by Mg_2Si precipitation, the effects of 0 to 0.4% Fe and 0 to 0.6% Mn or Cr have been assessed in materials of constant Mg and Si content. The alloys were hot and cold rolled to sheet; after solution heat treatment and room-temperature aging the properties varied only slightly with composition, strengthening being brought about by all three alloying additions. After subsequent artificial aging at 160°C alloys free from Mn or Cr were brittle and exhibited intercrystalline fracture in tension. Alloys containing Mn or Cr were both stronger and more ductile, fractures being mainly transcrystalline. Corrosion resistance was high in the room-temperature-aged materials, but susceptibility to intercrystalline attack was induced by artificial aging. Micrographic studies were particularly concerned with precipitation occurring at different stages in processing and heat treatment. By analogy with existing equilibrium data in related systems, the probable identities of the precipitate phases, and their significance in relation to the properties of the alloys, are discussed. (auth)

2462

THE FREE-ENERGY DIAGRAM OF THE SYSTEM TITANIUM-OXYGEN. O. Kubaschewski and W. A. Dench (National Physical Lab., Teddington, Middlesex, England). J. Inst. Metals 82, 87-91(1953) Oct.

Titanium–oxygen alloys of various compositions were equilibrated with calcium, magnesium, or barium mixed with its respective oxide in bombs of titanium or steel at temperatures between 950 and 1380°C. After leaching, the concentrations of oxygen in the titanium were determined by the vacuum-fusion method. The analytical data, the free energies of formation of the oxides of the alkaline-earth metals, and the heats and entropies of formation of the titanium oxides have been used to construct the free-energy concentration curves of the titanium–oxygen system at 1000 and 1200°C. (auth)

2463

THE NEW METAL TITANIUM. Maurice Cook (Imperial Chemical Industries, Ltd., Birmingham, England). J. Inst. Metals 82, 93-106(1953) Nov.

The history of titanium and the present developing production position are reviewed with reference to the technological problems peculiar to the metal in regard to its extraction and processing. The abundance of titanium ores and the properties of the metal and those of its alloys so far developed, indicate its possibilities as a basic or large-tonnage metal, but the essential requirement for its eventually attaining this position is the devising of cheaper production methods. After a brief survey of the extent and availability of titanium ores, methods for its production by dissociation of the tetraiodide and reduction of the tetrachloride with metallic magnesium are described, and details are given of its purification by vacuum treatment. Various other possible methods of extraction are mentioned, and the technology of arc melting titanium is described. The effect of impurities, particularly oxygen, nitrogen, carbon, and hydrogen, on the properties of the metal and its fabrication, its physical, mechanical, and corrosion-resistance characteristics are broadly considered. After noting the early work on alloy development, the structural features and properties of alloys now available are briefly described in the light of the constitutional effect of the elements used, and an indication is given of some of the chief differences between single-phase and duplex alloys. (auth)

2464

A SURVEY OF THE URANIUM-NICKEL SYSTEM WITH AN APPENDIX ON AN X-RAY EXAMINATION OF SOME URANIUM-NICKEL ALLOYS. J. D. Grogan, R. J. Pleasance, and Betty E. Williams (National Physical Lab., Teddington, Middlesex, England). J. Inst. Metals 82, 141-7(1953) Nov.

The liquidus of the system U–Ni takes the form of two eutectic troughs; one is composed of U_6Ni and a compound approximately U_7Ni_9, melting at 740°C and containing about 10.5 wt. % (33 at. %) Ni, the other of UNi_5 and Ni melting at 1110°C and containing about 71 wt. % (91 at. %) Ni. These are separated by a peak which rises to 1305°C, the melting point of UNi_5. The following compounds are formed by peritectic reactions: U_6Ni at 790°C; compounds approximately of compositions U_7Ni_9 and U_5Ni_7 at 785 and 820°C, respectively; UNi_2 at 985°C; and a compound containing 78 to 79 at. % Ni at 1290°C. Another compound occurs, containing approximately 77 at. % Ni. The exact ranges of composition and the formulas of the compounds have not been determined; the formulas suggested are adopted for

the sake of convenience. The existence of compounds U_6Ni, UNi_2, and UNi_5 has been established elsewhere by x-ray methods. The solid solubility of Ni in U is nearly 0.5 wt. % (2 at. %) at 790°C and decreases with temperature. The solid solubility of U in Ni is about 0.75 wt. % (0.18 at. %) at 1000°C and decreases with temperature. (auth)

2465

THE LOW-STRESS TORSIONAL CREEP PROPERTIES OF PURE ALUMINIUM. W. Betteridge (Mond Nickel Co., Ltd., Birmingham, England). J. Inst. Metals 82, 149-61(1953) Dec.

The creep properties of pure Al at 200°C have been determined by a high-sensitivity torsion method, at a torque producing a maximum elastic shear strain of 2.8×10^{-5}. The creep strain has been shown to be primarily dependent on the amount of cold work applied to the material and on the time and temperature of annealing treatments given before the creep test. The strain can be reduced to very small amounts by annealing at 600°C, but in order to prevent it completely annealing a temperature very close to the melting point would appear to be necessary. The creep strain is proportional to a simple fractional power of the time; the exponent lies between 0.1 and 0.6, the exact value depending primarily on the annealing temperature. There is evidence that the sum of two such power terms might be preferable in some cases. In the standard conditions of test, single crystals grown from the molten metal do not creep at all, but a small amount of initial plastic strain in torsion induces creep. A similar amount of strain in tension is ineffective. The results are interpreted as indicating that the mechanism by which the creep strain is produced is the movement of the dislocations existing in the material before test and that it is not associated with viscous movement at the grain boundaries. (auth)

2466

THE MELTING POINT OF TITANIUM. T. H. Schofield and A. E. Bacon (National Physical Lab., Teddington, Middlesex, England). J. Inst. Metals 82, 167-9(1953) Dec.

The melting point of Ti has been redetermined using a technique which reduces the possibility of contamination by refractories. Under approximately black-body conditions, the melting point is found to be 1660 ± 10°C. (auth)

2467

THE SYSTEM URANIUM–LEAD. B. R. T. Frost and J. T. Maskrey (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inst. Metals 82, 171-80(1953) Dec.

The system U–Pb has been investigated over the whole composition range and up to 1250°C by micrographic, x-ray, and thermal-analysis methods. Owing to the pyrophoric nature of the alloys at all except very dilute concentrations and to the tendency towards segregation, experimental techniques have been developed which contain novel features; in particular, use is made of a hot centrifuge to determine liquidus points. The solid solubilities at the U-rich and Pb-rich ends of the phase diagram are very small, so that Pb has little effect on the transformation temperatures of U. Two intermetallic compounds are formed, to which the formulas UPb and UPb_3 have been assigned; they melt congruently at 1280 and 1220°C, respectively. X-ray studies show UPB_3 to have a cubic structure. A subsidiary investigation revealed that a similar structure is formed at the composition UX_3, where X is Si, Ge, In, or Ga. The reason for the high melting points of these compounds, and for those of the other isomorphous compounds UAl_3 and USn_3, cannot be explained by consideration of size-factors. (auth)

2468

THE CONSTITUTION OF ALLOYS OF ALUMINIUM, COPPER, AND IRON. H. W. L. Phillips, (British Aluminium Co., Ltd., Gerrards Cross, Bucks, England). J. Inst. Metals 82, 197-212(1954) Jan.

The constitution of the Al-rich alloys of the Al–Cu–Fe system has been investigated over the range 0 to 40% Cu, 0 to 3.5% Fe by the methods of thermal analysis and microscopic examination, supplemented by measurements of liquid solubility. The constituents occurring over this range are Al, containing Cu and Fe in solid solution, the two binary phases $CuAl_2$ and $FeAl_3$, and two ternary bodies: α, isomorphous with $MnAl_6$, and β, originally designated N, and more recently Cu_2FeAl_7. Depending on the composition, the constituents α and β may separate independently, or they may be formed as the result of peritectic reactions, α from $FeAl_3$ and β from either $FeAl_3$ or α. The reaction involving the formation of α rarely proceeds to completion during solidification and takes place very slowly on annealing, even if the Fe content is low and the $FeAl_3$ finely dispersed. The reactions resulting in the formation of β take place more rapidly and may proceed to completion during slow solidification. It is believed that $FeAl_3$ is capable of taking only a small amount of Cu into solid solution, possibly 0.5%; that α has the approximate composition Cu 7, Fe 25%, with formula $Fe(Cu_{0.04}Al_{0.96})_6$ and electron/atom ratio of 2.12; and that β has an appreciable range of homogeneity, extending approximately from Cu 26.5, Fe 17.5% to Cu 33, Fe 13.5%. The solid solubility of Cu in Al is slightly reduced by the addition of Fe and that of Fe by the addition of Cu. The compositions of the Al-rich apices of the three-phase triangles at 500°C were found to be: Al, $FeAl_3$, α: Cu 0.4, Fe 0.0055%; Al, α, β: Cu 1.3, Fe 0.0055%; Al, β, $CuAl_2$: Cu 4.1, Fe 0.0040%. (auth)

2469

THE OXIDATION OF TITANIUM AT HIGH TEMPERATURES IN AN ATMOSPHERE OF PURE OXYGEN. A. E. Jenkins (Commonwealth Scientific and Industrial Research Organization, Univ. of Melbourne, Australia). J. Inst. Metals 82, 213-221(1954) Jan.

The oxidation of Ti has been investigated in the temperature range 600 to 925°C at an O_2 pressure of 700 mm of Hg. The process of oxidation was followed by determining the gain in weight of separate specimens after various periods. The distribution of O_2 between the scale and remaining metal core was determined in the temperature range in which physical stripping of the scale was possible, and in such instances an examination of the oxidation products was undertaken. The scales were found to be porous to O_2 and the oxidation process has been shown to occur at the metal oxide/metal interface. A glancing-angle x-ray-diffraction technique was used to establish the nature of the scales and surface layers on the metal cores; the rutile modification of TiO_2 was the only oxide observed in the scales. The surface layers of the metal cores were found to be composed of Ti–O solid solutions, the surface concentrations and internal O gradients of which were dependent on the oxidation temperature. A mechanism has been suggested for the oxidation of Ti at high temperatures, which involves the diffusion of O_2 within the metal core as an accelerating factor. (auth)

2470

THE STRUCTURE OF TITANIUM–SILVER ALLOYS IN THE RANGE 0-30 AT.-% SILVER. H. W. Worner (Commonwealth Scientific and Industrial Research Organization, Univ. of Melbourne, Australia). J. Inst. Metals 82, 222-6 (1954) Jan.

Metallographic and x-ray-diffraction methods have been used to determine a partial phase diagram between 0 and 30 at. % Ag, in the temperature range 650 to 1100°C. Addition of Ag to Ti depresses the $\alpha \rightleftharpoons \beta$ transformation; there is a eutectoid horizontal at 855°C, the reaction being: β (11.5 at. % Ag) $\rightleftharpoons \alpha$ (7 at. % Ag) + γ (28 at. % Ag). The β-solid-solution field extends to 23 at. % Ag at 1100°C. Solutions of

Ag in β Ti cannot be retained by quenching into water, as a rapid $\beta \rightarrow \alpha$ change occurs. The solubility of Ag in α Ti decreases from 7 at. % at the eutectoid temperature to 6 at. % at 700°C. The γ phase possesses an ordered structure based on the face-centered tegragonal lattice. The type of ordering appears to be similar to that shown by Cu_3Au (LI_2-type), but the degree of long-range order is low. Quenching from the β-solution field causes hardening of the alloys, the effect being of the order of 50 to 90 diamond pyramid hardness units for alloys in the range 6.5 to 22.3 at. % Ag. (auth)

2471

TENSION, SHEAR AND IMPACT STRENGTHS OF SPOT-WELDED TITANIUM JOINTS. M. L. Begeman, E. H. Block, Jr., and Frank W. McBee, Jr. (Univ. of Texas, Austin). Welding J. (N.Y.) 32, 599-s–604-s(1953) Dec.

Commercially pure Ti can be effectively spot welded, resulting in high-strength welds with moderate ductility. Under most conditions a ductility ratio or tension shear to direct tension ratio of 0.35 can be expected. Weld current and weld time apparently have only slight effect upon these values. Weld hardness is only moderately affected by varying either current or weld time. Impact strengths are increased directly as the heat is increased in the welding process. Under most conditions weld failure will be in the form of a plug or button. Weld-strength characteristics of commercially pure Ti most nearly approach the strengths obtained when SAE 1035 steel is spot welded and tempered. (auth)

2472

SPOT WELDING OF ALUMINUM, ALUMINUM ALLOYS AND STEEL. W. J. Wilson (Kaiser Metal Products, Inc., Bristol, Penna.). Welding J. (N.Y.) 32, 1175-80(1953) Dec.

Results of tests to establish welding techniques and schedules which would produce satisfactory welds in Al, Al alloys, and steel with special emphasis on welding force, time, current, and technique are presented. The problem of detecting and eliminating weld defects for production of good welds is discussed.

2473

QUALITY CONTROL IN SPOT WELDING ALUMINUM. Floyd H. Matthews. (Boeing Airplane Co., Seattle, Wash.). Welding J. (N.Y.) 32, 1181-94(1953) Dec.

Acceptable end-product results from establishment of satisfactory limits of operation for each phase of the process of quality control in spot welding Al and the maintenance of operation within these limits are discussed. (J.E.D.)

2474

THE USE OF CARBON CRUCIBLES IN MEASUREMENTS ON THE RATE OF EVAPORATION OF LIQUID METALS IN A VACUUM. M. G. Rossmann (The Royal Technical Coll., Glasgow, Scotland) and J. Yarwood (The Polytechnic, London, England). Brit. J. Appl. Phys. 5, 7-13(1954) Jan.

The conditions are discussed which need to be fulfilled to obtain measurements on the evaporation of metals which liquefy when at elevated temperatures in a vacuum. A new type of crucible for such work is described. The impedance of a crucible to flow of metal vapor is considered theoretically. Experimental results for the evaporation of Hg, Ag, and Au are given. (auth)

2475

A TECHNIQUE OF SOLDERING TO THIN METAL FILMS. Richard B. Belser (Georgia Inst. of Tech., Atlanta). Rev. Sci. Instr. 25, 180-3(1954) Feb.

In the past, soldering to thin metal films on glass or quartz substrates has normally been accomplished by suitably reinforcing the film at the soldering point with a thicker underlying film. This performance is necessary in order to prevent tin-lead solders and commonly used fluxes from destroying the film and to give better adhesion to the substrate. It has been found that by using the metal indium and certain of its alloys as a solder, without a flux, adherence to thin metal films may be readily obtained without destruction of the film. Since indium also adheres to glass, quartz, ceramics, and silicious minerals, the strength of the joint is not determined by the strength or adherence of the metal film but by the strength of the indium-glass or indium-quartz bond. Thus, films of only a few angstroms in thickness may be soldered without damage, with good mechanical strength and electrical contact. The strength of the bond is usually about 500 pounds per square inch. This technique has been found most useful in studying the resistivities of thin metal films and in the mounting of metal-coated piezoelectric crystals. Soldered connections have been made to films of 18 metals including aluminum, titanium, and zirconium. (auth)

2476

APPLICATION OF ELECTRON MICRODIFFRACTION TO THE STUDY OF Al–Cu ALLOY PHASE TRANSFORMATIONS. Noboru Takahashi and Charles Fert. Compt. rend. 237, 1864-6(1953) Dec. 21. (In French)

Microdiffraction techniques are applied to a film of Al–Cu alloy, obtained by evaporation and diffusion, permitting an observation of the phase transformation in the microcrystalline state. The principle is also applied to the transformation $CuAl \rightarrow Cu_9Al_4$. (tr-auth)

2477

FLUX ANNEALING REMOVES GAS FROM ALUMINUM–CLAD PLATES. E. J. Boyle (Oak Ridge National Lab., Tennessee). Iron Age 172, 145-7(1953) Aug. 13

Blistering of Al-clad plates, caused by H_2 precipitation when heated at 1100°F, can be prevented by flux annealing. This method eliminates difficulties of maintaining low humidity during melting and casting. Treatment consists of dipping in alcohol slurry of halide–Al brazing flux, drying at 300°F, and heating for 1 hr at 1100°F. Fluxing treatment on several thousand plates resulted in rejections of less than 1%. (auth)

2478

THE NATURE OF THE COMPOUND Ni_3Al. I. I. Kornilov and R. S. Mints. Doklady Akad. Nauk 88, 829-32(1953) Feb. 11. (In Russian)

Alloys of Ni-Al (up to 35% Al by wt.) were studied by using methods of physicochemical analysis and constructing compression property diagrams for electrical resistance and thermal expansion up to 1100°. On the isotherms for the coefficient for linear expansion, the compound Ni_3Al exhibits a singular minimum, while Ni-Al shows only an insignificant effect. Ni_3Al has a lower coefficient of linear expansion than either pure Ni or solid solutions of Al and Ni. Ni_3Al shows a singular point in all diagrams, including that of compression-heat stability. From the course of the isotherms of linear expansion, the authors surmise the possibility of a conversion of Ni_3Al at about 600°. (J.S.R.)

PHYSICS

*2479

David Sarnoff Research Center

ELECTRONIC DEVICES FOR NUCLEAR PHYSICS. QUARTERLY REPORT NO. 13 [FOR] JULY 1953–OCTOBER 1953. G. A. Morton, P. W. Davison, D. H. Fetters, M. H. Greenblatt, A. L. Solomon, and A. H. Sommer. Dec. 28,

1953. 17p. Contract W-7405-eng-26, Sub-308. (AECU-2795)

Experiments were conducted on the chemical analysis of photocathodes, the effect of low temperatures on photoemission of $SbCs_3$, and x-ray diffraction patterns of photoelectric materials. Attempts were made to find a suitable activation process for multialkali Sb photocathodes. Emission time of secondary electrons and performance of photomultipliers are reported. (For preceding period see AECU-2691.) (J.E.D.)

2480

Argonne National Lab.

PHYSICS DIVISION QUARTERLY REPORT [FOR] SEPTEMBER, OCTOBER, AND NOVEMBER 1953. Feb. 1954. 88p. Contract W-31-109-eng-38. (ANL-5174)

Experimental Nuclear Physics. Reflectivity tests for scintillation neutron detectors indicate that TiO_2-impregnated porcelain is the best choice for metal containers of large volume. Further data on fast neutron transmission measurements in Sb, Sb^{123}, Bi, Mg, Mn, Nb, and V are reported. Decay schemes for Tb^{160} and Cd^{117} are given, together with a study of the short-lived activities of Zn. The anisotropy of 900- and 370-kev γ radiation from the isomeric state of Pb^{204} was measured with foils dissolved in HNO_3 and H_2SO_4. Fourteen lines in the spectrum of T_2 at high pressure, previously reported, were found to be due to the assignment of certain electronic transitions. Theoretical Physics. Investigations of nuclear models and the energy states of light nuclei were continued. The contributions of 1p shell configurations to the ground-state wave function were calculated for A = 13 and 14. Theoretical study of the mechanism of internal conversion in heavy nuclei has been initiated by studying the conversion properties of low-energy transitions in the L and M shells. The results of calculated γ-γ angular correlation functions for Pb^{204} are presented. A method is discussed for solving the Dirac equation for fermions. (For preceding period see ANL-5140.) (K.S.)

2481

Columbia Radiation Lab., Columbia Univ.

QUARTERLY PROGRESS REPORT NO. 4. Oct. 30, 1953. 24p. Contract DA-36-039 SC-42519. (CU-4-53-SC-42519-Phys.)

The design and performance of new mm magnetrons are reported. Further investigations of the Cl^{35} and Cl^{37} nuclear quadrupole resonant lines and the microwave spectrum of OD^-, HCN, and DCN are presented. (For preceding period see CU-3-53-SC-42519-Phys.) (K.S.)

2482

Institute for Mathematics and Mechanics, New York Univ.

PERTURBATIONS ABOUT STRONG SPHERICAL SHOCK WAVES. Cathleen S. Morawetz. Jan. 1953. 21p. Contract Nonr-285(02). (IMM-NYU-189)

2483

Ames Lab.

ALPHA PARTICLE IONIZATION YIELDS IN A GRIDDED CHAMBER. Lloyd O. Herwig and Glenn H. Miller. [Jan. 28, 1954]. 3p. Contract W-7405-eng-82. (ISC-445)

The average energy per ion pair for α particles in various gases was measured by electron collection and compared with the values obtained from other investigations. The α source was natural U. Results are given in tabular form. (J.A.G.)

2484

National Bureau of Standards

THE HEAT CAPACITY OF LITHIUM FROM 25° TO 900°C; THE HEAT OF FUSION AND THE TRIPLE POINT; THERMODYNAMIC PROPERTIES OF THE SOLID AND LIQUID. Thomas B. Douglas and James L. Dever, National Bureau of Standards and Leo F. Epstein and William H. Howland, Knolls Atomic Power Lab. Oct. 16, 1953. 36p. (NBS-2879)

Two samples of lithium were purified by vacuum distillation in a stainless steel still between 650 and 700°C and were sealed in capsules made of type 347 stainless steel. Chemical analysis indicated the first sample to have a purity of 99.98 at. % and the second sample, in whose distillation the still was heated in vacuum, a purity of 99.99 at. %. Precise measurements of the temperatures during fusion, which can be interpreted in approximate agreement with these analyses, indicate a triple point of pure lithium of 180.54°C. Using a Bunsen ice calorimeter and drop method, precise enthalpy measurements relative to 0°C were made at 13 temperatures from 50 to 900°C. From the resulting values were calculated the heat capacity, entropy, and free energy from 298.16 to 1200°K, after making a correction of the best available heat capacities at low temperatures. From the thermal data and the most consistent vapor pressure measurements available in the literature, the vapor pressure was calculated over this temperature range. (auth)

2485

Research Lab. of Electronics, Mass. Inst. of Tecn.

QUARTERLY PROGRESS REPORT [NO. 31 FOR THE PERIOD ENDING AUGUST 31, 1953]. J. B. Wiesner, G. G. Harvey, and H. J. Zimmermann. Oct. 15, 1953. 72p. Contract DA-36-039-sc-100. (NP-4975)

Measurements of the ratio of the real to the imaginary part of the electron conductivity were made as a function of the average electron energy in the afterglow of a pulsed He discharge. The phenomenon of plasma resonance in H is investigated, together with a study of the steady-state microwave gas discharge by movable probes. Microwave spectroscopic investigations of the lines in O_2, Hg, and the quadrupole moment of Na^{23} are reported. Microwave tube research during the quarter included studies of the noise and propagation of electron beams and the characteristics of internally coated cathodes. Projects previously reported in this series on theoretical communications research were continued. The design of a high-Q microwave resonator is described. Expressions for the magnetic field configuration inside microwave cavities and waveguides containing ferrite are developed. (For preceding period see NP-4867.) (K.S.)

2486

Joint Establishment for Nuclear Energy Research (Norway)

SECOND ANNUAL REPORT, 1952/53. 45p. (NP-5068)

The operation of JEEP in its second year is summarized, including shielding, fuel rods, inspection, and control. A chemical research department was created in the beginning of 1953. Radioisotope production and research are briefly noted. Physics research on neutron spectroscopy and diffraction is progressing. Design studies have started on a heavy water moderated power reactor with natural U as fuel. (J.S.R.)

2487

Catholic Univ. of America

ELECTRICAL EFFECTS AT PHASE BOUNDARIES. FINAL REPORT. G. W. Castellan, A. Norbert MacDonald, Peter Breisacher, and Francis Wehner. June 15, 1953. 52p. Contract AT-(40-1)-1072. (ORO-107)

The charge produced on a Hg droplet when it breaks from a metal tip depends on the nature of the metal tip, the manner in which the drop breaks from the tip, and wetting of the tip by the Hg. Some evidence is reported which indicates that the negative charge has a preference for the smaller drop. When fracture takes place near the interface, the sign of the charge on the drop is determined by the relative escaping tendencies of the electrons in the two metals; if the

work function of the metal is larger than that of Hg, the Hg drop is positively charged, and vice versa. When Hg wets the tip, fracture occurs at some distance from the tip. The distribution of the electron gas in a long, thin metal wire under the influence of gravity was calculated. Similar calculations are reported for the distribution of electrons between two different metals. (L.T.W.)

2488

THE DISPLACEMENT OF MAGNETO-ELECTRONIC SPIRALS IN AN ELECTROSTATIC FIELD. Lodis Cartan. Translated from Compt. rend. 197, 1604-6(1933). 2p. Available from Associated Technical Services (Trans. No. 51E2F), East Orange, N. J. (AEC-tr-1768)

2489

THE PROBLEM OF MEASURING THE DECOMPOSITION VOLTAGE OF MOLTEN ELECTROLYTES IN THE PRESENCE OF GLASS DIAPHRAGMS. N. G. [E]. Chovnyk. Translated from Zhur. Fiz. Khim. 23, 839-48(1949). 12p. (AEC-tr-1816)

A study was made of the change in the decomposition voltages of molten AgCl, $PbCl_2$, $CdCl_2$, AgCl–NaCl, and $PbCl_2$–NaCl, as a function of the electrolysis time when glass diaphragms are used. Decomposition voltages of individual molten salts, measured with a glass diaphragm present, were found to rise as the electrolysis time increased, attaining values that were substantially above the emf of the respective chemical circuits. It has been found that the decomposition voltages of molten salts attain constant value in the presence of Na ion after the electrodes are saturated, the values being close to the emf of the respective bonds of formation. (auth)

2490

IMPULSE METHOD OF DETERMINING SPECIFIC HEAT. (Impul'snyi Metod Opredeleniya Teploemkosti). V. I. Khotkevich and N. N. Bagrov. Translated from Doklady Akad. Nauk S.S.S.R. 81, 1055-7(1951). 4p. (AEC-tr-1817)

The specific heat of a metal may be determined by subjecting the sample, in the form of a thin wire, to a rectangular constant current impulse from a battery of accumulators and recording the magnitude of the current and the voltage drop with an oscillograph. If the rate of heating is sufficiently high, heat loss to the external medium may be ignored, and the specific heat at any given temperature can be calculated from the usual formulas. Examples are given. (J.S.R.)

2491

A NEW METHOD FOR THE DETERMINATION OF THE MODULUS OF ELASTICITY AND DAMPING. Fritz Förster and [W. Köester]. Translated by Yvette De Felice from Z. Metallkunde 29, 116-23(1937). 19p. (AEC-tr-1819)

An electromagnetic method of measuring the characteristic vibration and damping of randomly shaped objects is described. The influence of various factors, such as arrangement of the experimental set-up, the temperature, and the shape of the test object, is evaluated. (J.S.R.)

2492

CONCERNING THE PLASTIC-ELASTIC STATE. K. Bennewitz and H. Rötger. Translated by C. B. Mills from Physik. Z. 40, 416-28(1939). 8p. (AEC-tr-1831)

2493

HEAT EXCHANGE BETWEEN A SOLID BODY AND HELIUM II. (Teploobmen Mezhdu Tverdym Telom i Geliem II). I. M. Khalatnikov. Translated from Zhur. Ekspti'. i Teoret. Fiz. 22, 687-704(1953). 19p. Available from the Dept. of Scientific and Industrial Research, London. (CTS-25)

An abstract of this article appears in Nuclear Science Abstracts as NSA 7-1152.

2494

THE INFLUENCE OF DIMENSIONS ON THE CRITICAL FIELD OF SUPER CONDUCTORS OF THE SECOND GROUP. (Vliyanie Razmerov Na Kriticheskoe Pole Sverkhprovodnikov Vtori Gruppy). A. A. Abrikosov. Translated from Doklady Akad. Nauk S.S.S.R. 86, 489-92(1952). 4p. Available from the Dept. of Scientific and Industrial Research, London. (CTS-29)

2495

ON THE BEHAVIOUR OF SUPER-CONDUCTIVE FILMS IN A MAGNETIC FIELD. (O Povendenii Sverkhprovodyashchikh Plenok V Magnitnom Pole). V. L. Ginzburg. Translated from Doklady Akad. Nauk S.S.S.R. 83, 385-8(1952). 4p. Available from the Dept. of Scientific and Industrial Research, London. (CTS-30)

2496

HEAT CONDUCTIVITY AND SOUND ABSORPTION IN HELIUM II. (Teploprovodnost'i Pogloshchenie Zvuka V Gelii II). I. M. Khalatnikov. Translated from Zhur. Eksptl'. i Teoret. Fiz. 23, 21-34(1952). 12p. Available from the Dept. of Scientific and Industrial Research, London. (CTS-34)

2497

THEORY OF THERMOGRADIENT DRYING OF FILMS. B. V. Deryagin, I. N. Goufman, A. G. Amelin, and S. M. Levi. Translated from Doklady Akad. Nauk S.S.S.R. 92, 759-62(1953). 5p. (NSF-tr-213)

A drying method which is based on producing a temperature gradient inside the film being dried and which shortens the drying period and eliminates the danger of damage from dust particles and droplets of water is described. (J.A.G.)

2498

ON THE FORMULATION OF RULES FOR THE FILLING OF ELECTRON LEVELS. V. M. Klechkovskii [Klechkovsky]. Translated from Doklady Akad. Nauk S.S.S.R. 92, 923-6 (1953). 4p. (NSF-tr-220)

A particular problem connected with the filling of quantum levels by electrons as a function of atomic number Z is the prediction of that point, Z_l where quantum levels with a preassigned azimuthal quantum number l are first filled with s, p, d, or f electrons. It is pointed that the statistical Fermi-Thomas relationship $Z_l = 0.155\ (2l + 1)^3$ (without exchange corrections) provides a better fit to observed data when the constant 0.155 is replaced by a function $\gamma(Z)$ which approaches 0.169 for large Z. A nonstatistical approach is then applied to the problem, which yields an expression of the form $Z_l = \gamma(l)\ (2l + 1)^3$, where $\gamma(l) = 0.333\ l\ [(2l + 2)/(2l + 1)^2] + 1/(2l + 1)^3$, including exchange corrections. Evaluation of $\gamma(l)$ for $l = 0, 1, 2, 3$, gives values of the order of the Fermi-Thomas constant 0.155. (K.S.)

2499

FIRST SOUND IN LIQUID HELIUM AT HIGH PRESSURES. K. R. Atkins and R. A. Stasior (Univ. of Toronto, Canada). Can. J. Phys. 31, 1156-64(1953) Nov.

The velocity of ordinary sound in liquid He has been measured in the temperature range from 1.2 to 4.2°K at pressures up to 69 atm. A pulse technique was used with a carrier frequency of 12 Mc. Curves are given for the variation of velocity with temperature at constant pressure and also at constant density. There is no detectable discontinuity along the λ curve. The results are used to discuss the ratio of the specific heats, the coefficient of expansion below 0.6°K, and the specific heat above 3°K. (auth)

2500

THE SURFACE TENSION OF LIQUID HELIUM. K. R. Atkins (Univ. of Toronto, Canada). Can. J. Phys. 31, 1165-9 (1953) Nov.

Following a suggestion due to Frenkel, the normal modes of a liquid-He surface are taken to be surface-tension waves. The free energy associated with these modes is estimated and is found to give a major contribution to the temperature dependence of the surface tension of liquid He II. The zero-point energy of the modes is shown to be an appreciable fraction of the total surface energy at 0°K. (auth)

2501
THE ADSORPTION AND THE MAGNETIC ORTHO-PARA CONVERSION OF HYDROGEN ON DIAMAGNETIC SOLIDS. I. SOME EXPERIMENTS IN SURFACE PARAMAGNETISM. Y. L. Sandler (National Research Labs., Ottawa, Canada). J. Phys. Chem. 58, 54-7(1954) Jan.

The rates of the magnetic ortho-para conversion of H_2 adsorbed on some diamagnetic solids are determined and the true half lives are found by means of adsorption measurements. True half lives of 1 to 6 min are found with $BaSO_4$ and 2 samples of TiO_2 at 90°K. The appearance of a strong blue color in a sample of TiO_2 due to loss of oxygen on heating in vacuo and disappearance of the color on contact with O_2 at room temperature is accompanied by changes in surface paramagnetism, as determined by the parahydrogen conversion. A method for estimating the number of extraelectrons due to surface defects is indicated; for this, the found true conversion rate is compared with the true conversion rate in presence of measured amounts of O_2 adsorbed on diamagnetic surfaces. The true half life on a solid D_2O surface is found to be about 10 hr; this is shown to be the expected order of magnitude if compared with conversion rates of H_2, dissolved in diamagnetic liquids. (auth)

2502
THE ADSORPTION AND ORTHO-PARA CONVERSION OF HYDROGEN ON DIAMAGNETIC SOLIDS. II. THE RELATIVE ADSORBABILITIES OF ORTHOHYDROGEN AND PARAHYDROGEN. Y. L. Sandler (National Research Labs., Ottawa, Canada). J. Phys. Chem. 58, 58-61(1954) Jan.

It is shown that orthohydrogen is more strongly adsorbed than parahydrogen when physically adsorbed on TiO_2 or charcoals. A separation factor of about 1.6 is observed with TiO_2 at −183°. The effect of the preferential adsorption on the kinetics of the ortho-para conversion is demonstrated. It may be obscured by a lag in the establishment of the adsorption equilibrium. The separation effect is explained as being principally due to hindered rotation. (auth)

2503
SECOND SOUND IN He^3–He^4 MIXTURES BELOW 1°K. J. C. King and Henry A. Fairbank (Yale Univ., New Haven, Conn.). Phys. Rev. 93, 21-7(1954) Jan. 1.

An investigation has been made of second sound in mixtures of He^3–He^4 in the temperature region obtained by demagnetization of a paramagnetic salt. Several concentrations of He^3 were used ranging between 0.0017 % and 4.3 %. The velocity of second sound for the mixtures was found to reach a maximum value of about 35 m/sec just below 1°K and to approach 20 m/sec near 0.2°K. In addition, essentially no dispersion of second-sound pulses in mixture below 1°K was observed. This is in marked contrast to heat pulses in pure He^4 in this temperature region. Our results show general agreement with the theoretical predictions of Pomeranchuk, provided the effective mass μ of the He^3 atom is allowed to vary from 2.0 m_3 at 0.2°K to 3.6 m_3 at 1.8°K. (auth)

2504
THE VAPOR-PRESSURE CURVE OF HELIUM BETWEEN 4.2°K and 4.8°K. R. D. Worley, M. W. Zemansky, and H. A. Boorse (Columbia Univ., New York). Phys. Rev. 93, 45-6 (1954) Jan. 1.

Measurements of the resistance of four Allen-Bradley carbon resistors in the liquid helium temperature range from 1.8° to 4.2°K and at the hydrogen triple point have been fitted to smooth calibration curves. When the resistance is measured at helium vapor pressures from 760 mm to 1350 mm, and the corresponding temperatures are obtained from the so-called "agreed" scale of Van Dijk and Shoenberg, the calibration points in this range do not lie on these calibration curves. This discrepancy and the fact that the vapor pressure-temperature relation above 4.2°K has not been determined since 1915 suggest that a redetermination of the vapor pressure-temperature relation above 760 mm is desirable. (auth)

2505
VISCOSITY OF GASEOUS He^3 AND He^4 BETWEEN 1.3°K AND 4.2°K. E. W. Becker and R. Misenta (Univ. of Marburg, Germany) and F. Schmeissner (Inst. for Low Temperature Physics, Herrsching n. Münich, Germany). Phys. Rev. 93, 244-5(1954) Jan. 1.

Halpern (Phys. Rev. 82, 561(1951)) suggested that the viscosity difference of gaseous He^3 and He^4 at very low temperatures be measured to determine the influence of symmetry effect on the gaskinetic cross sections. Results are presented in this note for this measurement between 1.3 and 4.2°K. Results for pure He^4 agree well with the calculations of de Boer and Cohen (Physica 17, 993(1951)), and He^3 shows a small deviation at low temperatures. In any case, the results obtained confirm the predicted symmetry effect. The concentration dependence of viscosity of gaseous He^3-He^4 mixtures determined at 4.2 and 2.6°K is also shown. (L.M.T.)

COSMIC RADIATION

*2506
Radiation Lab., Univ. of Calif., Berkeley
PART A: A CLOUD-CHAMBER STUDY OF COSMIC-RAY AIR SHOWERS AT SEA LEVEL. PART B: A DIFFUSION CLOUD CHAMBER OF UNUSUALLY LARGE DIMENSIONS (thesis). Kenneth E. Relf and Wilson M. Powell. Nov. 1953. 115p. Contract W-7405-eng-48. (UCRL-2412)

A diffusion-type cloud chamber 8 ft long, 4 ft wide, and 5 in. deep has been used to study the lateral structure of cosmic-ray air showers in a region near the core. Three showers were recorded in which the core lay within 60 to 90 cm from some point on the periphery of the chamber. The results show that the lateral distribution of the shower particles in all but one photograph follow exceedingly well the Molière distribution. The deviations from the Molière distribution are almost all within the expected Gaussian fluctuations. In those pictures exhibiting little or no gradient, the deviations from the average density were normal. In addition to the experimental results on air showers, a detailed description of the cloud chamber is given, since it is an unusually large chamber. Though the actual area is 32 ft^2, the area photographed was 21 ft^2 or very nearly 2 m^2. The chamber was operated continuously for 30 days (720 hr) in which the chamber performed satisfactorily for 540 hr. (auth)

2507
DETERMINATION OF THE MASS OF COSMIC RAY PARTICLES FROM THEIR IONIZING POWER. A. I. Alikhanyan and V. M. Kharitonov. Translated from Doklady Akad. Nauk S.S.S.R. 92, 1125-8(1953). 4p. (NSF-tr-225)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-1603.

2508
ENERGETIC NUCLEAR COLLISIONS IN THE UPPER ATMOSPHERE. I. THE NUCLEON-PION CASCADE. U. Haber-Schaim (Weizmann Inst. of Science, Rehovoth,

Israel) and G. Yekutieli (IAEC, Tel Aviv, Israel). Nuovo cimento (9) 11, 172-87(1954) Feb. (In English)

The nucleon-pion cascade in the upper atmosphere is treated by an extension of the Fermi theory of pion production. The cascade equations are solved by an expansion in powers of the atmospheric depth. The contribution of primary α particles is considered in detail. The results are applied to the calculation of the attenuation mean free path of the nucleonic component and the ratio of neutral to charged nuclear particles. (auth)

2509

ON A POSSIBLE NEGATIVE K $\rightarrow \pi$ MESON DECAY. E. Amaldi, G. Baroni, C. Castagnoli, G. Cortini, C. Franzinetti, and A. Manfredini (Univ. of Rome, Italy). Nuovo cimento (9) 11, 207-9(1954) Feb. (In English)

In emulsions exposed at high altitudes, two K mesons were observed. The first K meson crossed 8 emulsions and appeared to decay to a π^- meson. The second K meson crossed 9 emulsions and showed a scattering 3 mm before escape from the last emulsion. The masses of the K particles were $1060 \pm 50\ m_e$ and $\sim 1000\ m_e$, respectively. (J.S.R.)

2510

ON POSSIBLE EJECTION OF A MESON-ACTIVE TRITON FROM A NUCLEAR DISINTEGRATION. A. Bonetti, R. Levi Setti, M. Panetti (Univ. of Milan, Italy), L. Scarsi (Istituto Nazionale di Fisica Nucleare, Milan, Italy), and G. Tomasini (Univ. of Genoa, Italy). Nuovo cimento (9) 11, 210-12(1954) Feb. (In English)

In emulsions exposed at high altitudes the ejection of an unstable heavy particle from a nuclear disintegration was observed. The particle is emitted from a star and comes to rest after 12.2 cm. Two tracks seem to originate from the end of the primary, a short heavily ionizing track and a 2.38-cm track in the opposite direction. The long track was shown to be a π^- meson with energy 39.4 ± 1 Mev. The short branch, if assumed to be a He^3 nucleus, has a recoil energy of 2.3 Mev. The measured mass of the primary is $5860 \pm 2\ M_e$, and it is singly charged. This indicates the spontaneous decay of the excited triton: $H_1^{3*} \rightarrow H_2^3 + \pi^- + Q$. (J.S.R.)

2511

MEAN LIFE-TIME OF MESONS IN ALUMINIUM, SULFUR AND LEAD. A. G. Tenner (Univ. of Amsterdam, Netherlands). Physica 20, 24-8(1954) Jan. (In English)

A new set up is described which allows the measurement of the mean life time of positive and negative cosmic-ray mesons in different absorbers. From the results the capture probabilities for negative mesons in aluminum and and sulfur have been calculated. The results are $1/\tau_c = .77 \times 10^6$ per sec for aluminum and 1.18×10^6 per sec for sulfur. (auth)

2512

NEUTRON MEASUREMENTS AT GREAT UNDERGROUND DEPTHS. J. Eugster (Univ. of Zürich, Switzerland). Rev. Sci. Instr. 25, 5-7(1954) Jan.

A preliminary report on extensive measurements of the cosmic-ray intensities at medium underground (5880 m.w.e.) is given. In these experiments, carried out during 1951 and 1952, two identical portions of photographic plates, one bare and one shielded with Cd, were exposed at identical temperature. For the controls, which were exposed at the surface of the earth, there was found a good agreement between the results and those obtained by Yagoda and Kaplan (Phys. Rev. 76, 702(1949)) for slow neutrons. The Cd difference counts obtained at the underground station were much higher than the controls. (auth)

2513

HEAVY MESONS. A. I. Alikhanov. Uspekhi Fiz. Nauk 50, 481-538(1953) Aug. (In Russian)

The observations of cosmic rays at sea level and at high altitudes, made by the author and other workers, are reviewed. Particular emphasis is placed on the analysis of traces left by heavy mesons. The results are tabulated, and the existence of excited protons is postulated. (J.S.R.)

2514

ATMOSPHERIC TEMPERATURE EFFECT FOR μ MESONS OBSERVED AT A DEPTH OF 846 m.w.e. Noah Sherman (Univ. of Michigan, Ann Arbor). Phys. Rev. 93, 208-11 (1954) Jan. 1.

The experiment reported was a measurement of the effect of variations in atmospheric temperatures on the intensity of μ mesons observed underground at a depth of 846 m.w.e. The average energy of these particles is known to be $\sim 2 \times 10^{11}$ ev. A total of $\sim 1.2 \times 10^6$ coincidences, between two large trays of Geiger counters located in a salt mine, was collected over a two-year period. The correlation between variations in counting rate and simultaneous variations in effective atmospheric temperature was analyzed. The effective temperature was determined from radiosonde measurements of atmospheric temperatures at pressure levels up to 20 millibars performed by a U. S. Air Force weather observation unit near the salt mine. The resulting temperature coefficient is 0.22 ± 0.06 percent per degree and the correlation coefficient is 0.75. The results are compared with those obtained from similar measurements at 1574 m.w.e. and with the theoretical values of the temperature coefficient derived from various schemes describing the production of μ mesons with high energies. (auth)

2515

PROTON INTENSITIES AT SEA LEVEL AND 9000 FEET. Arthur Z. Rosen (Univ. of California, Santa Barbara). Phys. Rev. 93, 211-14(1954) Jan. 1.

The vertical intensities of protons which occur singly in the cosmic radiation have been measured at 9000 feet and at sea level. The particles observed were those whose momenta, recorded by cloud chambers above and below a magnetic field, were between 0.59 and 0.93 Bev/c after having traversed various thicknesses from 0 to 345 g/cm^2 of lead absorber placed over the apparatus. The identification of the particles was achieved by a mass determination based on the measured momentum and the range observed in a third cloud chamber containing copper plates. With no absorber over the apparatus, the differential momentum intensity at 9000 feet was found to be $8.9 \pm 0.9 \times 10^{-4}$ (Bev/c)$^{-1}$ sec^{-1} sterad^{-1} cm^{-2}. In conjunction with the data obtained at sea level with the same apparatus, an effective absorption length of 136^{+13}_{-8} g/cm^2 of air was found for protons of the mean momentum 0.76 Bev/c. From this absorption length and the evidence that production between the two levels of observation plays a predominant role, a value of 134 g/cm^2 for the absorption length of the primary particles was deduced. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

2516

ON THE POSSIBLE DEVELOPMENT OF THE THEORY OF DISLOCATIONS. V. I. Arkharov, G. N. Kolesnikov, and A. N. Orlov. Translated from Doklady Akad. Nauk S.S.S.R. 92, 751-4(1953). 4p. (NSF-tr-212)

2517

ISOTOPE EFFECT AND THERMAL EXPANSION COEFFICIENTS OF CRYSTALS. Christer E. Nordman and William N. Lipscomb (Univ. of Minnesota, Minneapolis). J. Chem. Phys. 21, 2077(1953) Nov.

When H is replaced by D, a contraction (which is temperature dependent) occurs in the LiH crystal, whereas an expansion occurs in those crystals containing short H bands. A quantitative discussion of the thermal expansion coefficients of LiH, LiD, and LiT is outlined. The coef-

ficients are calculated to be 3.9×10^{-5}/degree for LiT. (J.S.R.)

2518
STRUCTURE ANALYSIS OF SINGLE CRYSTALS BY ELECTRON DIFFRACTION. III. MODIFICATIONS OF ALUMINA. J. M. Cowley (Commonwealth Scientific and Industrial Research Organization, Melbourne, Australia). Acta Cryst. 6, 846-53(1953) Nov.

An electron-diffraction study of the oxide films formed by heating Al foil in air on metal grid supports has revealed the occurrence of a number of new phases arbitrarily designated the λ, μ, ν, ξ and ξ' phases. Except for the λ phase, all these phases may be indexed in terms of hexagonal unit cells with $\underline{a} \sim 5$ A and $\underline{c} \sim 14$ A and appear to be intermediate between the α- and γ-alumina phases. The λ phase is orthorhombic, pseudotetragonal, with $\underline{a} = \underline{b} = 7.63$ and $\underline{c} = 2.89$ A and has a superlattice with a unit cell containing 14 normal unit cells. Poor-quality single-crystal patterns of the λ phase have been used in the structure analysis of the average unit cell and the superlattice unit cell as a demonstration of the amount of information which can be derived from imperfect single-crystal patterns and of the effectiveness of image-seeking methods in the interpretation of Patterson projections obtained from electron-diffraction data. The [001] projection of the average unit cell was refined by using the values of $\frac{1}{2}(E'_{hk} + E^2_{hk}/E'_{hk})$ as Fourier coefficients, the E'_{hk} being the structure factors calculated for the approximate structure found by image seeking. The composition of the λ phase is approximately $3NiO \cdot 5Al_2O_3$. (auth)

2519
THE STRUCTURE OF α(AlCrSi)-$Cr_4Si_4Al_{13}$. Keith Robinson (Cavendish Lab., Cambridge, England). Acta Cryst. 6, 854-59(1953) Nov.

The crystal structure of the intermetallic compound $Cr_4Si_4Al_{13}$ has been determined. The main framework of the structure is a network of linked tetrahedra of Cr, Si, and Al atoms, the latter being in 4-coördination. The form of the first prominent Brillouin zone of the structure suggests that Cr has a negative 'effective valency' in this compound and electron counts indicate a small excess of electrons in the Cr atoms. Unusually short interatomic distances between Cr and Al, similar to those previously reported for Mn and Al in Mn_3SiAl_9, occur in the structure. (auth)

ELECTRICAL DISCHARGE

2520
OSCILLATIONS OF THE PLASMA IN CROSSED ELECTRIC AND MAGNETIC FIELDS. A. I. Akhiezer [Akhiyezer] and R. V. Polovin. Translated from Zhur. Tekh. Fiz. 22, 1794-1802(1952). 18p. (AEC-tr-1820)

ELECTRONS

2521
NOTES. ELECTROSTATIC DEFLECTION AND SPECIFIC CHARGE OF THE POSITIVE ELECTRON. STUDY OF THE PHYSICAL PROPERTIES OF THE POSITRON. Jean Thibaud. Translated from Compt. rend. 197, 447-8; 915-17(1933). 4p. Available from Associated Technical Services (Trans. No. 50E2F-a; 50E2F-b), East Orange, N. J. (AEC-tr-1767)

2522
THE CONSTRUCTION OF AN ELECTRON TRAJECTORY IN POTENTIAL FIELDS. G. B. Hagen (Heinrick-Hertz-Institut für Schwingungsforschung, Berlin-Adlerskof, Germany). Ann. Physik 13, 257-84(1953) Dec. (In German)

The accuracy of the graphic construction of an electron trajectory in potential fields was investigated. The construction method of which the Snellius refraction law forms the basis and the construction method involving a tangent to the instantaneous radius of curvature are discussed. It was determined which angles of incidence, which ratio of the electron entry and exit velocity, and which angles of inclination lead to errors within the accuracy range. Numerical data are presented. The measurement shows that the construction by which the instantaneous radius of curvature is determined offers no advantage. (tr-auth)

2523
APPROXIMATE ELECTRODE SHAPES FOR A CYLINDRICAL ELECTRON BEAM. E. R. Harrison (Atomic Energy Research Establishment, Harwell, Berks, England). Brit. J. Appl. Phys. 5, 40-1(1954) Jan.

For a parallel cylindrically symmetrical electron beam, in which the current is space-charge limited, the accelerating electrodes have varying shapes which previously have been determined with the electrolytic tank. With the aid of some approximations, a simple equation is obtained for the shapes of such electrodes. The errors involved are a maximum for the cathode surface; for most other electrodes, it is found that this equation gives results indistinguishable from those determined experimentally and can therefore be used in the design of those electrodes for which there are no data. (auth)

2524
NOTE ON THE SECONDARY ELECTRON EMISSION BY METALS BOMBARDED WITH IONS. J. Sommeria (Lab. de Synthèse Atomique, Ivry (Seine), France). J. phys. radium 15, 126(1954) Feb. (In French)

The secondary electron emission from metals bombarded with electrons increases with the atomic number. However, the secondary electron emission from metals bombarded with ions is greater for light metals than for heavy metals. The results of experiments with Duralumin and Cu are presented graphically. (J.S.R.)

2525
ON THE FOCUSING OF HIGH-CURRENT ELECTRON BEAMS. George R. Brewer (Electron Tube Lab., Hughes Research and Development Laboratories, Culver City, Calif.). J. Appl. Phys. 25, 243-51(1954) Feb.

The focusing of high-current electron beams by means of a system of periodically spaced magnetic lenses has been studied. The trajectories of the electrons under the influence of magnetic and space charge forces have been obtained by the use of an analog computer. Graphs have been prepared which permit the design of a lens focusing system for given values of current, voltage, and beam diameter. The solutions are obtained for the Glaser magnetic lens with longitudinal field variation of the form $B_z = B_0(1 + (z/a)^2)^{-1}$. The conditions of operation appropriate to the minimum chromatic aberration are obtained, and the entrance conditions to the lens system discussed. (auth)

2526
A THEORY OF THE ELECTRON. H. T. Flint and E. M. Williamson (Univ. of London, England). Nuovo cimento (9) 11, 188-99(1954) Feb. (In English)

A theory of the electron is proposed by analogy with the gravitational theory of matter. It is essentially a classical theory based upon equations of the form suggested by Mie. The use of five-dimensional analysis results naturally in the appearance of a field of the Yukawa vector type in addition to the electromagnetic field. The theory of the electron is thus brought into line with theories of the nuclear field. The analogy leads directly to the results obtained by Bopp and accounts for the mass of the electron by means of the energy of the field. (auth)

2527
RELATIVISTIC SCATTERING OF ELECTRONS AND THE BORN APPROXIMATION. E. Corinaldesi (Dublin Inst. for

Advanced Studies, Irish Free State). Nuovo cimento (9) 11, 200-2(1954) Feb. (In English)

The exact scattering amplitude of electrons at infinite energy is compared with the amplitude given by the Born approximation. By using the potential $V(r) = -(Ze^2/r)(1 - \exp[-r/R])$, the Born approximation gives good agreement with the experimental results on the scattering of 116-Mev electrons. (J.S.R.)

GASES

2528

TEMPERATURE JUMP AND VELOCITY OF SLIP AT THE BOUNDARY OF A GAS. Herbert Payne (Wright-Patterson Air Force Base, Ohio). J. Chem. Phys. 21, 2127-31(1953) Dec.

Approximate expressions are derived from the kinetic theory for the temperature jump and the velocity of slip occurring at an infinite plane solid surface of constant temperature bounding a gas whose state remains invariant throughout all planes parallel to the surface. These derivations differ from earlier ones in the elimination of an assumption, for which an argument is presented as to its untenability, regarding the distribution of the velocities of the molecules striking the surface. Instead, from the mathematical theory of nonuniform gases are derived conditions on this distribution sufficient to confine possible values of the temperature jump and slip velocity to within fairly close limits. (auth)

2529

DIFFUSION AND THERMAL DIFFUSION OF ISOTOPIC GASES. Eugene M. Holleran (St. John's Univ., Brooklyn). J. Chem. Phys. 21, 2184-7(1953) Dec.

The thermal diffusion ratio, R_T, for A and Ne isotopes is known to be a linear function of lnT over a considerable temperature range. It is shown that d lnD/d lnT must also be approximately linear in lnT and that the diffusion coefficient, D, should therefore obey an empirical equation of the form $D = \alpha T^{(\beta+\gamma \ln T)}$, where α, β, and γ are constants. Considerable latitude is possible in the values of these constants which can reproduce the diffusion data available at the present time. Satisfactory values of β and γ can be found from thermal diffusion data. Except for the factor α, D(T) can thus be calculated from $R_T(T)$. It is also possible to calculate the thermal diffusion ratio as a function of temperature from measurements of the diffusion coefficient, but completely reliable results require more extensive diffusion data than are now available. (auth)

INSTRUMENTS

*2530

Phillips Petroleum Co., Atomic Energy Div.

A ROD-TYPE THERMISTOR CALORIMETER. E. E. Burdick. Oct. 26, 1953. Decl. Mar. 2, 1954. 11p. Contract AT(10-1)-205. (IDO-16124)

A rod-type thermistor calorimeter, its calibration, and an associated constant-temperature bath is described. The calorimeter is designed for routine self-heating measurements of radioactive samples and is sufficiently sensitive down to 1 mw. (auth)

*2531

Livermore Research Lab., California Research and Development Co.

MODULATED LIGHT BEAM TELEMETERING OF HIGH POTENTIAL-ISOLATED PULSE SIGNALS. H. J. Strickland. Feb. 1954. 8p. Contract AT(11-1)-74. (LRL-94)

Monitoring of slow repetition rate pulse waveforms which originate within a high potential or radiation area was desired at a control console. A system of modulating a glow discharge tube to give a linear variation of light output with input current was used as the telemetering transmitter, and a photomultiplier tube was used as the telemetering receiver. The light beam was shielded from extraneous light by an insulating tube. Direct current amplifiers were used in both units to convey information of relative d-c levels and improve frequency response. Multichannel systems may be employed. (auth)

2532

Radiation Lab., Univ. of Calif., Berkeley

THE WOLTER PHASEPLATE IN ULTRACENTRIFUGATION AND ELECTROPHORESIS. Rodes Trautman and Victor W. Burns. Jan. 1954. 22p. Contract W-7405-eng-48. (UCRL-2453)

An inexpensive practical phaseplate available commercially is described. Illustrations are given of its use in electrophoresis and ultracentrifugation equipment as a schlieren diaphragm, the operational heart of the schlieren optical system. Practically, the use of the phaseplate is warranted when high magnification angles are used, the refractive index gradient curve is steep, and disturbances in the cell are to be seen most clearly. Theoretically, the phaseplate confirms concepts of the nature of the diffraction fringes from any schlieren diaphragm, since it operates on diffraction due to defocusing of the light-source image by the lens action of the gradient. Distèche's and Wolter's theories of the fringes are contrasted. The phaseplate also makes more clear the nature of the anomaly of schlieren patterns near the baseline, which show different shapes according to the orientation of the opaque edge. (auth)

2533

APPLICATION OF COMPUTING MACHINES TO ION EXCHANGE COLUMN CALCULATIONS. Ascher Opler (Dow Chemical Co., Pittsburg, Calif.) Ind. Eng. Chem. 45, 2621-9 (1953) Dec.

Results of an intensive exploration of the possibilities of applying digital computing machines to the mathematical treatment of ion exchange column performance are presented. Using a simple, slow-speed, punched-card-operated computer, several different types of calculation were programmed, and typical ion exchange problems were solved. The 602-A calculating punch was programmed using the standard wire-programming method, control panels, and a card-programming method which uses an instruction code on each card. The latter proved most suitable for operations that were relatively simple and for probability calculations. Studies are reported on adaptability of results of equilibrium-stage treatment to machine computation, carrying out numerical evaluation of kinetic solution for various operating conditions, development of finite-difference methods of simulating column performance, extension of the simulation technique to cover practical cases, comparison of different calculating methods, and the capability of treating problems of column diameter and nonuniform flow by Monte Carlo methods. (J.A.G.)

2534

IMAGE-CONVERTER CAMERA FOR STUDIES OF EXPLOSIVE PHENOMENA. F. C. Gibson, M. L. Bowser, C. W. Ramaley, and F. H. Scott (U. S. Bureau of Mines, Pittsburgh). Rev. Sci. Instr. 25, 173-6(1954) Feb.

A single-frame camera is described which uses a pulsed image-converter tube as a shutter to give 10^{-7}-second exposures. The image-converter tube converts an optical image into an electron image and reconverts it into an optical image; gating or deflection in the electron phase is easily accomplished. Circuits and methods for application to single-frame photography of high explosive phenomena are given and representative photographs are shown. (auth)

MASS SPECTROGRAPHY

2535

MASS SPECTROMETRY. Vernon H. Dibeler (National Bureau of Standards, Washington, D. C.). Anal. Chem. 26, 58-65 (1954) Jan.

A survey of the literature on mass spectrometry is presented. References are included on instrumentation, methods, and techniques; ionization and dissociation by electron impact; application to physical chemistry and chemical physics; analytical applications; precise mass measurement; measurement and application of isotopic abundance; and nuclear chemistry. 343 references. (J.A.G.)

2536

METASTABLE NEGATIVE IONS. B. L. Donnally and H. E. Carr (Alabama Polytechnic Inst., Auburn). Phys. Rev. 93, 111-14(1954) Jan. 1.

Metastable negative ions have been detected with a mass spectrometer during an electron bombardment study of ethyl dichlorophosphate. Seven transitions for these metastable negative ions are tabulated, and the half lives of two of these ions have been measured using a method proposed by Hipple. Measurements on the metastable ions in the transitions $C_2H_5PO_2Cl_2^- \rightarrow PO_2Cl^- + [C_2H_5Cl]$ and $PO_2Cl^- \rightarrow Cl^- + [PO_2]$ give 1.9×10^{-6} and 4.8×10^{-6} sec, respectively, as their half-lives. (auth)

2537

ION TRAJECTORIES IN THE OMEGATRON. Clifford E. Berry (Consolidated Engineering Corp., Pasadena, Calif.). J. Appl. Phys. 25, 28-31(1954) Jan.

The equations of motion for ions in an idealized two-dimensional Omegatron are solved for the general case of arbitrary initial velocity and arbitrary starting time. A simple picture of the paths is obtained by use of a rotating coördinate system. (auth)

MATHEMATICS

2538

Columbia Univ.

CONFIDENCE INTERVALS OF FIXED LENGTH FOR THE POISSON MEAN AND THE DIFFERENCE BETWEEN TWO POISSON MEANS. Allan Birnbaum. Dec. 28, 1953. 5p. (NP-5052)

2539

Columbia Univ.

STATISTICAL METHODS FOR POISSON PROCESSES AND EXPONENTIAL POPULATIONS. A. Birnbaum. [1953?] 19p. (NP-5053)

2540

Radiation Lab., Univ. of Calif., Berkeley

CONVERGENCE AND SUMMABILITY OF ORTHOGONAL SERIES. John Killeen. Oct. 6, 1953. 62p. Contract W-7405-eng-48. (UCRL-2388)

An orthogonal series $\sum_{n=1}^{\infty} a_n \phi_n(x)$ is considered, where $\{\phi_n(x)\}$ is an arbitrary orthonormal system for the interval (a, b) and $\{a_n\}$ is a sequence of real numbers. A collection of theorems which give sufficient conditions for the convergence almost everywhere in (a, b) and summability a.e. in (a, b) of the series is presented. These theorems were established by Menchoff, Kaczmarz, Orlicz, Rademacher, and Zygmund. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

2541

Los Alamos Scientific Lab.

THE DETECTION OF NEUTRONS WITH A LARGE LIQUID SCINTILLATION COUNTER. F. Reines, C. L. Cowan, Jr., F. B. Harrison, and D. S. Carter. [1953] Decl. Mar. 4, 1954. 56p. [Contract W-7405-eng-36]. (AECD-3617)

A cylindrical liquid scintillation counter, 75 cm in diameter and 75 cm high, has been used for the detection of neutrons, gamma rays, and cosmic-ray μ mesons. A delayed coincidence technique has been used to detect neutrons: the first pulse corresponding to a recoil proton or other associated event, the second pulse due to neutron capture in cadmium. The capture rate of neutrons in a solution containing toluene and cadmium has been calculated as a function of the cadmium-to-hydrogen ratio by the Monte Carlo method, and an experimental check performed. Detector design considerations and some possible uses are described. (auth)

2542

Atomic Energy Research Establishment, Harwell, Berks (England)

CAUSES OF INSTABILITY IN THE PROBE UNIT TYPE 1014a. C. D. Florida and C. N. Davey. Dec. 21, 1953. 7p. (AERE-EL/M-85)

Modifications for the 1014a probe unit, a quench circuit for Geiger counters, to eliminate instability are discussed. A schematic diagram of the new circuit with modifications is presented. (J.A.G.)

*2543

Hanford Works

A PORTABLE SCINTILLATION TYPE ALPHA SURVEY INSTRUMENT. W. G. Spear. Feb. 1, 1954. 14p. Contract W-31-109-Eng-52. (HW-30713)

A portable α survey instrument with a rectangular probe having reasonable sensitive area to total volume ratio and adequate resistance to damage was developed. The methods and circuits used in the design are outlined. (J.S.R.)

2544

Hanford Works

A PULSE ANALYSIS METHOD FOR THE DETERMINATION OF A LOW-ENERGY GAMMA EMITTER IN A RADIONUCLIDE MIXTURE. U. L. Upson, R. E. Connally, and M. B. Leboeuf. Feb. 8, 1954. Decl. Mar. 9, 1954. 17p. Contract W-31-109-eng-52. (HW-30897)

A modified γ scintillation spectrometer employing a Tl-activated NaI crystal is described which permits the semi-quantitative determination of a low-energy γ emitter in the presence of gross interference from high energy β-γ emitters. Evaluation of the low-energy constituent in a mixed sample is obtained through the preferential counting of only those pulses having amplitudes between two selected discriminator levels. This pulse channel is chosen to correspond to a γ energy band characteristic of the desired constituent. Discrimination against channel counts due to beta, bremsstrahlung, and Compton scattering of emission from the interfering substances is effected by minimizing such scattering through the low-mass, low-Z environment for the sample, reducing high-energy γ interactions within the crystal through use of a very thin crystal, and automatic instrumental compensation for the remaining extraneous contribution to the gross channel count. Data on the performance of the instrument are included. (C.H.)

*2545

North American Aviation, Inc.

PREPARATION OF INDIUM FOILS ON A SUBSTRATE OF POLYVINYL ACETAL. J. H. Thompson and J. M. Nuding. Mar. 15, 1954. 10p. Contract AT-11-1-GEN-8. (NAA-SR-851)

Neutron absorbers from 1 to 15 mg/cm^2 in thickness were prepared by evaporation of indium onto polyvinyl acetal films 0.5 mg/cm^2 in thickness. (auth)

2546

Department of Mines and Technical Surveys, Mines Branch (Canada)

A MILL FEED MONITOR FOR RADIOACTIVE ORES. A. H. Bettens and C. M. Lapointe. Jan. 4, 1954. 7p. (NP-5083; TR-114/54)

A coincidence unit is described which was used to minimize the high and variable background radiation and scan a defined portion of the ore on the conveyor belt. A schematic diagram of the mill feed belt monitor is given, including the coincidence counter and rate meter. (J.E.D.)

2547

New York Univ., Coll. of Engineering

THE EFFECT OF CONTAMINANTS ON THE OPERATIONAL BEHAVIOR OF BF_3 COUNTERS. Nancy Dorny 1954. 46p. Contract N6 ONR-279, T. O. 12, Report No. 2. (NP-5085)

The theory of proportional counters is reviewed, and the performance of BF_3-filled counters in the detection of neutrons is discussed. The importance of using a high purity BF_3 gas as a filling gas is stressed, and a procedure is described for the purification of BF_3 gas and subsequent filling of the counters with the gas. A series of nine counters of different cathode materials were attached to a manifold so the identical gas filling would be present in each, and a 25-mc Po-Be neutron source was placed in the center of the circle formed by the counters. Three separate fillings of the counters were made to test the purification procedure for BF_3 gas, to determine the effects of contamination arising from reactions between BF_3 and organic materials, and to investigate the effect of A on the characteristic counting rate curves. Data are presented graphically. (C.H.)

2548

Carbide and Carbon Chemicals Co. (Y-12)

THE MASS SPECTROMETER; A LITERATURE SEARCH. Frances L. Sachs and John W. Wachter. July 25, 1953. 405p. Contract W-7405-eng-26. (Y-958)

A literature search of information on the design and construction of mass spectrometers and related topics is presented. (K.S.)

2549

AN EFFICIENT ARRANGEMENT OF STARTING A LIGHTING TUBE FOR ILLUMINATING A WILSON CHAMBER WITHOUT AN AUXILLIARY ELECTRODE. A. Rogozinski (Inst. d'Astrophysique, Paris, France). J. phys. radium 15, 123(1954) Feb.

The arrangement consists of a Hg valve, characterized by a 10-kv inverse voltage from the anode and by a Delco lighting coil from an internal combustion engine. A schematic diagram of the apparatus is given. (J.S.R.)

2550

DOSAGE TABLES FOR COBALT 60 FOR USE WITH INTERSTITIAL, PLAQUE, AND INTRACAVITARY APPLICATIONS. Isadore Meschan, George Regnier, James W. Nelson, and Arland W. Lafferty (Univ. of Arkansas, School of Medicine, Little Rock). Am. J. Roentgenol. Radium Therapy Nuclear Med. 71, 320-32(1954) Feb.

Dosage tables for Co^{60} utilization are presented. These tables permit the utilization of Co^{60} in Paterson-Parker distribution schemes, and reasonably good homogeneity is obtained. Tables are also presented which indicate the dosage delivered in γ r/mc/hr around linear sources 1 mm in diameter and 1 to 6 cm in length when encased in 16 gage hyperchrome steel, and for sources 4 mm in diameter and 1 cm in length when encased in 2-mm brass. An additional table is presented for use with a 2-mm brass capsule which contains a 1-cm by 4-mm cylinder of Co^{60} with a 5- by 4-mm cylinder of Pb at each end. (auth)

2551

CHARACTERISTICS OF RADIOLUMINESCENCE IN CRYSTALS. G. T. Wright and G. F. J. Garlick (Univ. of Birmingham, England). Brit. J. Appl. Phys. 5, 13-18(1954) Jan.

Measurements of scintillation light output vs. α-particle energy are made for single crystals of organic and inorganic substances excited by monoenergetic α particles. A new method is used to deduce a relation between the differential efficiency dL/dx and the specific energy loss dE/dx, which in the case of CaF_2 is verified experimentally using thin evaporated layers. The effect of phosphorescent decay is observed by varying the circuit time constant. The intrinsic spread in scintillation pulse magnitude due to the phosphor is studied by inserting neutral filters between phosphor and photomultiplier and by variation in particle energy. Apart from a spread due to surface irregularities, sources of spread are observed in diamond, probably due to alternation of fluorescent and nonfluorescent crystal domains, and in anthracene, most likely due to knock-on protons near the end of the α-particle track. (auth)

2552

EXPERIMENTAL DETERMINATION OF RANGE-ENERGY RELATIONS OF NUCLEAR EMULSIONS OF VARYING COMPOSITIONS. COMPARISON OF SLOWING DOWN POWER IN THESE EMULSIONS. Léopold Vigneron and Georges Philbert. Compt. rend. 237, 1675-7(1953) Dec. 21. (In French)

Normal C_2 emulsions, containing 82.8% halogen salt, and dilute emulsions containing 73.3% and 65.5% halogen salt, were compared. The α ranges observed are in agreement with ranges calculated by Bogaardt and Vigneron (J. phys. rad. 11, 652(1952)), verifying their theoretical calculations. A table of relative slowing-down power for the C_2 emulsion, comparing the results of two other evaluations, is given for protons and α particles. (tr-auth)

2553

CALCULATION OF RANGE-ENERGY RELATIONS FOR PHOTOGRAPHIC EMULSIONS OF VARIOUS COMPOSITIONS. COMPARISON WITH EXPERIMENTAL DETERMINATIONS. Maarten Bogaardt and Bob Koudijs. Compt. rend. 237, 1678-9(1953) Dec. 21. (In French)

New values for the ionization potential and the introduction of "empirical potentials" permit the calculation of range-energy relations in emulsions of varying chemical composition. The experimentally determined α ranges are in excellent agreement with the calculated results. (tr-auth)

2554

A NEW TECHNIQUE FOR MEASURING THE ACTIVITY OF COMPOUNDS LABELED WITH SOFT β EMITTERS. Jean-Claude Roucayrol and Erich Oberhausen. Compt. rend. 237, 1680-2(1953) Dec. 21. (In French)

A simple, inexpensive technique for measuring relative β activity by scintillations produced in a liquid medium is described. The technique uses a photo-multiplier and electrometer tube with a passive system of samples of a particular type. Linearity, accuracy, and sensitivity are satisfactory. (tr-auth)

2555

ON THE SHRINKAGE FACTOR OF NUCLEAR EMULSIONS. L. H. Greenberg and R. N. H. Haslam (Univ. of Saskatchewan, Saskatoon, Canada). Can. J. Phys. 31, 1115-20(1953) Nov.

A simple and accurate method to determine the shrinkage factor of nuclear emulsions is presented. Its use shows that the shrinkage factor is not a function of the angle of inclination of the α particle tracks in the emulsion. (auth)

2556

AUTOMATIC COUNTING OF A STATISTICAL DISTRIBUTION AT TIME INTERVALS (APPLICATION TO THE α EMISSION OF Po). Roland Chéry (Université de Lyon, France). J. phys. radium 15, 72-82(1954) Feb. (In French)

The apparatus described was made in order to resume the study of the time distribution of radioactive emissions, but it can be easily adapted to the study of other phenomena statistically distributed in time. Each emission is registered by a luminescent point on the screen of a cathode tube. One can utilize the apparatus for the study of correlations between the appearance of two statistic emissions, each of which controls the position of a spot according to a coördinate. (tr-auth)

2557
THE PROBLEM OF THE COUNTING OF α PARTICLES IN A 2π GEOMETRY. Eugène Cotton, Antoine Lévèque and René Cohen (Centre d'Études Nucléaires, Gif-sur-Yvette (Seine-et-Oise), France). J. phys. radium 15, 109-17(1954) Feb. (In French)

The study of the energetic spectrum of α particles issuing from a plane layer and with low density has shown that the abrupt introduction of the value of the superficial mass of the deposit in the correction for self-absorption leads to incorrect results. A method is described which allows the precise determination of this correction. The uncertainty of the value of the correction term due to the retrodiffusion of α particles by the support of the layer does not permit the determination of absolute activities with an error lower than 0.5 or 1 out of 100 according to the case. (tr-auth)

2558
IMPROVEMENT OF THE TECHNIQUE OF NUCLEAR EMULSIONS. G. Marguin and M. Maitrot (Inst. de Physique Atomique de Lyon, France). J. phys. radium 15, 123-4 (1954)

Many applications of nuclear emulsions necessitate the complete removal of background traces from the emulsion without any impairment of its sensitivity. The background may be removed by placing the plate in a water-saturated atmosphere at 60°C for a period of 24 hr. Raising the temperature accelerates the process and does not affect the sensitivity. The contraction of the emulsion can be suppressed by placing it in glycerine prior to treatment. (J.S.R.)

2559
INFLUENCE OF FADING ON THE MEASUREMENT OF MASS RATIOS IN NUCLEAR EMULSIONS. Krister Kristiansson (Univ. of Lund., Sweden). Nature 173, 78-9 (1954) Jan. 9.

An explanation of a previously reported (von Friesen and Kristiansson, Nature 168, 377(1951)) deviation from 1.32 of a photoelectric measurement of track densities in determining the relative masses of π and μ mesons in nuclear emulsions is presented. (J.A.G.)

2560
OCCURRENCE OF A FISSION-DUST PARTICLE IN A NUCLEAR EMULSION. Herman Yagoda (National Institutes of Health, Bethesda, Md.). Nature 173, 79 (1954) Jan. 9.

A β-active inclusion found microscopically in a nuclear emulsion exposed to cosmic radiation in the stratosphere is discussed. When examined under conditions of high resolution, the tracks were seen to originate from an opaque, nearly spherical granule of 5 to 10 μ diam. One α track with a recorded range of 14 ± 1 μ is associated with the embedded grain. The fused appearance of the inclusion, together with its β and α activity, suggests that it may have originated from an atomic weapons detonation. (J.A.G.)

2561
A STABLE HIGH SPEED MULTICHANNEL PULSE ANALYZER. E. Gatti (Laboratori CISE, Milan, Italy). Nuovo cimento (9) 11, 153-62(1954) Feb. (In English)

A twenty-channel pulse analyzer with a resolving power of 3 μsec is described. Its chief feature is that pulse section is accomplished by a single discriminator for each channel whose threshold is set at a height corresponding to the upper boundary of the channel, and the channel width is determined by suitably shaping the incoming pulses. (auth)

2562
A DIFFUSION CLOUD CHAMBER WITH A MAGNETIC FIELD FOR NUCLEAR PHYSICS. A. Lovati and C. Succi (Univ. of Milan, Italy). Nuovo cimento (9) 11, 163-71(1954) Feb. (In Italian)

A diffusion cloud chamber for use in nuclear research and its auxiliary equipment is described. The bottom of this chamber is cooled by an industrial refrigerator. Observations on the performance under different operating conditions are reported. (auth)

2563
AN IMPROVED CLINICAL DOSIMETER FOR THE MEASUREMENT OF RADIATION. S. O. Fedoruk, H. E. Johns, and T. A. Watson (Saskatoon Cancer Clinic, Saskatchewan, Canada). Radiology 62, 177-82(1954) Feb.

By the use of recently developed hearing-aid pentodes a d-c amplifier consisting of only two tubes can be constructed which will readily measure dosage rates of 1 r/hr with a chamber volume of 0.1 cc. The amplifier operating off small batteries has a short time constant and good zero stability. It is being used extensively for pelvic and esophageal measurements during x-ray and radium treatment and in determining the output of radium molds. The device is useful in a number of physical investigations, as of back-scatter and depth dose. (auth)

2564
PHOTOCATHODE UNIFORMITY AND RESOLUTION OF SCINTILLATION SPECTROMETERS. T. F. Godlove and W. G. Wadey (Yale Univ., New Haven, Conn.). Rev. Sci. Instr. 25, 1-4(1954) Jan.

Sixteen photomultiplier tubes were studied to determine the relation between the uniformity of their photocathodes and the resolution obtained from a γ-ray scintillation spectrometer using each of them. The sensitivity contours of the tubes were plotted. The resolution was found to be related to the average sensitivity but could be improved by concentrating the light on the most sensitive part of the photocathode. Techniques for studying sensitivity with an artificial light flasher are described. (auth)

2565
VARIABLE FIELD BETA-RAY SPECTROMETER-SPECTROGRAPH. Robert Katz and Milford R. Lee (Kansas State College, Manhattan). Rev. Sci. Instr. 25, 58-62(1954) Jan.

The design and performance of a high source type, 180° focusing, variable field, beta-ray spectrometer-spectrograph are described. Some details regarding the measurement of magnetic field, the construction of end-window Geiger counters, and the preparation and thickness measurement of thin Formvar counter windows are also discussed. (auth)

2566
A FAST NEUTRON SCINTILLATOR. W. S. Emmerich (Westinghouse Research Lab., East Pittsburg, Penna.). Rev. Sci. Instr. 25, 69-70(1954) Jan.

A fast neutron scintillator adapted to end-window photomultipliers is described for neutron detection above ~0.3-Mev energy. Light pulses are produced by the action of recoil protons from paraffine on zinc sulfide phosphor, the optimum weight ratio of the paraffine-zinc sulfide mixture being 3:2. Interfering gamma-ray pulses are suppressed by a 3 microsecond time-constant in the photomultiplier

output circuit, and subsequent amplitude discrimination. A detection efficiency of 3.8 percent is attained for 4.1-Mev neutrons through the incorporation of ½-inch-deep Lucite light guides. (auth)

2567

A LOW-PRESSURE COUNTER FOR MEASUREMENTS OF GASEOUS ADSORPTION ON SOLIDS. J. A. Dillon, Jr. and H. E. Farnsworth (Brown Univ., Providence, R. I.). Rev. Sci. Instr. 25, 96(1954) Jan.

A low-pressure end-window counter constructed inside the vacuum system makes possible more accurate measurements of gas absorption since the samples do not have to be removed from the system, a process in which they usually become contaminated by atmospheric or counter gases. A complete description is presented of the construction and operation of the counter and of the techniques to be used in the measurements to insure accurate results. (L.M.T.)

2568

AN OPTICAL SYSTEM FOR THE ILLUMINATION OF A DEEP WILSON CHAMBER. C. Ballario, M. Beneventano, B. Brunelli, A. De Marco (Instituto di Fisica dell' Università, Rome, Italy). Rev. Sci. Instr. 25, 99-100(1954) Jan.

A necessary feature of Wilson cloud chamber illumination systems is that the light beam be homogeneous and well defined so that contrast is not spoiled by light scattered from the velvet at the back of the chamber. The optical system described here which comprises a lens, cylindrical mirror, and two parabolic mirror segments appears to satisfy this and other requirements. By choosing suitable constants for the system it is usually possible to arrange that the nonparallel rays which enter the chamber do not touch either the velvet or front glass. (L.M.T.)

2569

A SCINTILLATION PAIR SPECTROMETER. Harry I. West, Jr. and L. G. Mann (Stanford Univ., Stanford, Calif.). Rev. Sci. Instr. 25, 129-35(1954) Feb.

A scintillation pair spectrometer involving the use of three NaI(Tl) crystals has been developed which has a high rejection of all unwanted pulses. As in the usual scintillation pair spectrometer, the gamma rays pass into a center crystal and the pair events are selected by detecting the two annihilation quanta in two side crystals. High rejection of unwanted coincidences is obtained by using a cathode-ray tube differential discriminator set on the photoelectron peaks of the annihilation quanta in the side crystals, along with coincidence circuits of moderately good resolution (0.15 μsec). In this way pair distributions from Na^{24} (1.38 and 2.76 Mev) and Co^{60} (1.17 and 1.33) have been observed with almost no background. The apparatus has also been found useful in many other scintillation counter applications involving energy differentiation and coincidence counting. (auth)

2570

DETECTION OF 2.5-Mev NEUTRONS WITH A SINGLE-CRYSTAL SCINTILLATION COUNTER. Ralph E. Segel, C. D. Swartz, and George E. Owen (Johns Hopkins Univ., Baltimore, Maryland). Rev. Sci. Instr. 25, 140-4(1954) Feb.

The spectrum of pulse heights from a stilbene scintillation counter exposed to approximately monoenergetic neutrons is subject to a number of inherent distortions. It is shown that the neutron energy and intensity can be determined rather simply by proper analysis of the experimental data. The reduction of background by various types of collimation is described. (auth)

2571

AN ION CURRENT INTEGRATOR. Raphael Littauer (Lab. of Nuclear Studies, Cornell Univ., Ithaca, New York). Rev. Sci. Instr. 25, 148-52(1954) Feb.

An electronic integrator suitable for measuring ionization currents down to 10^{-11} ampere is described. The instrument simultaneously displays both the instantaneous value of the current and the total charge received. Automatic recycling is achieved with the aid of a contact mounted on the movement of a standard meter. Substantial lengths of coaxial cable with standard connectors may be connected to the input without producing unduly large leakage currents or changing the calibration, so that remote operation of the integrator is feasible. (auth)

2572

A SPECIMEN HEATER FOR ELECTRON DIFFRACTION. R. G. Picard and E. G. Dornfeld (Radio Corp. of America, RCA Victor Division, Camden, N. J.). Rev. Sci. Instr. 25, 158-60(1954) Feb.

An electric specimen heater for diffraction studies at temperatures up to 1500°F is described. Specimens up to ½-inch square may be heated by the element which fits in the vacuum chamber upon the regular stage of an RCA-Type EMD-2 diffraction camera. The principal problem is the reduction of stray magnetic fields from heater wires to a negligible value. This is achieved by using low current in high-resistance wire and reverse winding the heater coils. Radiation and conduction losses are cut to a minimum by enclosing the heater element in "LAVA" (hydrous Al silicate) except for a window over which the specimen is mounted. D-c power is taken from the power supply for the valving system. (auth)

2573

A NEUTRON-SENSITIVE IONIZATION CHAMBER WITH ELECTRICALLY ADJUSTED GAMMA COMPENSATION. H. S. McCreary, Jr. and Robert T. Bayard (Westinghouse Electric Corp., Bettis Field, Pittsburgh). Rev. Sci. Instr. 25, 161-4(1954) Feb.

The use of neutron-sensitive ionization chambers for neutron flux measurement in nuclear reactors is discussed along with the limitation in neutron detection range because of the gamma-ray background in which the chamber must operate. Means of extending this range are also discussed and a new type of compensated ionization chamber is described. The compensation adjustment of this new chamber is made electrically rather than mechanically as in prior compensated chambers. The extension in neutron detection range over that of an uncompensated chamber is of the order of two decades. Frequent adjustment of the compensation is not necessary since the drift is small over a long period of time. (auth)

2574

LINK COUPLING FOR NUCLEAR MAGNETIC RESONANCE. Henry L. Richter, Jr., Floyd B. Humphrey, and Don M. Yost (Calif. Inst. of Tech., Pasadena). Rev. Sci. Instr. 25, 190(1954) Feb.

It was found that in normal arrangements in which the oscillator tank coil is at the end of a coaxial probe the use of proton magnetic resonance for regulation of magnetic fields of 10 kilogauss or more gave inadequate, if any, resonance lines above 40 Mc. This was attributed to the fact that the distributed inductance of the coaxial line becomes important as frequency is increased. This was overcome by the link-type coupling arrangement described in this note, which utilizes lumped circuit elements for the oscillator tank circuit which are completely contained within the oscillator compartment of the unit. (L.M.T.)

2575

A BETA-RAY MICROSCOPE. William Kerr and H. J. Gomberg (Univ. of Mich., Ann Arbor). Science 119, 51-5 (1954) Jan. 8. (cf. NSA 7-2971)

A β-ray microscope is described which has given satisfactory results in the detection of β particles from specimens containing Co^{60}, Tl^{204}, C^{14}, and Ni^{63}, when activities were of the order of 1 $\mu c/cm^2$. A block diagram of the β-ray microscope is presented, and discussions are included of the expected resolution and sensitivity of the proposed system, the noise problem, results obtained, and proposed improvements. (C.H.)

2576

SWELLING AND CONTRACTION OF NUCLEAR EMULSIONS. G. Meulemans (Univ. Libre de Bruxelles, Belgium) and G. Mignone (Univ. de Gênes). Science et inds. phot. 23A, 309-15(1953). (In French)

The swelling of the gelatin on moving the plate from the fixer solution to the wash can be limited by addition of Na_2SO_4 to the hypo and slow dilution instead of abrupt transition from the hyposulfite solution to water. The contraction of the emulsion on drying can be compensated for by impregnation of glycerine into the emulsion. Methods of assuring homogeneity of impregnation are given. (J.S.R.)

MESONS

2577

ON THE CHOICE OF THE "UNPERTURBED" ENERGY OPERATOR IN THE THEORY OF THE INTERACTION OF A NUCLEON WITH THE PSEUDOSCALAR MESON FIELD. Yu. V. Novozhilov. Translated from Doklady Akad. Nauk S.S.S.R. 92, 931-3(1953). 4p. (NSF-tr-217)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-1663.

2578

CAPTURE OF μ^--MESONS BY DEUTERONS. A. Rudik. Translated from Doklady Akad. Nauk S.S.S.R. 92, 739-42 (1953). 4p. (NSF-tr-219)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-1661.

2579

SECOND THEORETICAL PERTURBATION APPROXIMATION OF MESON-NUCLEAR SCATTERING. G. P. Weber (Univ. of Jena, Germany). Ann. Physik 13, 369-80(1953) Dec. (In German)

The contribution of the second theoretical perturbation approximation to the differential effective cross section of the π meson-nuclear scattering was ascertained in a charged pseudoscalar meson theory with pseudoscalar coupling for the case of disappearing meson mass in its total energy dependence. In the case of forward scattering, the meson developed by setting the meson mass to zero was estimated. The total effective cross section was calculated for extreme relativistic energy values. (tr-auth)

2580

DETERMINATION OF THE MASS OF SLOW PARTICLES BY THE CONSTANT SAGITTA METHOD. C. Dilworth, S. J. Goldsack, and L. Hirschberg (Univ. Libre de Bruxelles, Belgium). Nuovo cimento (9) 11, 113-26(1954) Feb. (In English)

A method is described in which the measurement of scattering of tracks at the end of their range is carried out on sets of cells of varying length, chosen so that the second difference of the sagitta remains constant. This permits the measurements to be made always at the optimum cell length and eliminates the inconveniences and inaccuracies of the methods in which the track is broken into several sections for measurement. The mass values of a series of K and J particles have been determined, together with those of a group of protons which serves as calibration. (auth)

2581

THE ANOMALOUS LARGE ANGLE SCATTERING OF μ MESONS. J. P. Davidson (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil). Nuovo cimento (9) 11, 205-6(1954) Feb. (In English)

The anomalous scattering of μ mesons can be explained by the interaction of the meson's coulomb field with the entire target nucleus. (J.S.R.)

2582

ANALYSIS OF V-EVENTS. J. Podolanski and R. Armenteros (Univ. of Manchester, England). Phil. Mag. (7) 45, 13-30(1954) Jan.

From the observed momenta and angles of decays in flight, variables are constructed which are better suited for analysis than the measured quantities themselves. These variables are $1/P$, the reciprocal of the primary momentum, α, a combination of the longitudinal momenta of the secondaries, and either p_t, the transverse momentum, or the quantity $\epsilon = 2p_t/P$. The regularities in the distribution of the new variables, to be expected from a two-body decay, are discussed. The decay scheme may be derived by comparison with the experimental distributions. (auth)

2583

THE MEAN LIFETIME OF THE V_1^0-PARTICLES. D. I. Page and J. A. Newth (Univ. of Manchester, England). Phil. Mag. (7) 45, 38-46(1954) Jan.

The mean lifetime of V_1^0 particles has been determined from measurements on 26 selected V decays observed in a large cloud chamber. The chief criterion for selection was that the momentum of the positive secondary particle should be at least three times as great as that of the negative particle. It is shown that this selects events which are predominantly V_1^0 decays. The decay scheme of the particles is assumed to be $V_1^0 \rightarrow P^+ + \pi^-$ + ~37 Mev. The result of the analysis gives a value of $(3.7^{+3.8}_{-1.3}) \times 10^{-10}$ sec for the mean lifetime. Combining this with other published values, it is concluded that the lifetime is probably between 3.0 and 4.5×10^{-10} sec. (auth)

2584

ANGULAR AND ENERGY DISTRIBUTIONS IN ENERGETIC PION INTERACTIONS WITH NUCLEI. A. H. Morrish (McGill Univ., Montreal, Canada). Phil. Mag. (7) 45, 47-57 (1954) Jan.

A total of 405 events due to the interaction of 210 ± 20 π^- mesons with the nuclei of photographic emulsions are analyzed. Angular and energy distributions of the charged reaction products are interpreted as giving evidence of a cascade process for those events in which the meson survives. The characteristics of the remaining events, in which the meson is either absorbed or undergoes charge exchange, are primarily determined by the evaporation process. (auth)

2585

HIGH-ENERGY MESON PRODUCTION. N. M. Duller (Rice Inst., Houston, Texas) and W. D. Walker (Univ. of Rochester, New York). Phys. Rev. 93, 215-26(1954) Jan. 1.

The angular distributions of penetrating secondary particles from showers originating in lead and in carbon have been studied. Because the distributions for the two materials are very similar, it seemed meaningful to analyze them in terms of nucleon-nucleon collisions. From the kinetics of such collisions, it is possible to estimate the energy of the primary producing the interaction. If the angular distribution in the center-of-mass system is uniform, then

$$\frac{F(\theta)}{1-F(\theta)} = \gamma_c^2 \tan^2\theta$$

where $F(\theta)$ is the fraction of the shower particles emitted within an angle θ in the laboratory system and γ_c is the γ of the center-of-mass motion. By making plots of $\log[F/(1-F)]$

vs log tanθ, the γ_c of the interaction is found. Also, it is established that the angular distribution of particles produced in 10–40 Bev interactions is uniform in the center-of-mass system. The average number of mesons produced in showers of about 30-Bev primary energy is 3 to 4. From estimates of secondary momenta it appears that, on the average, the mesons are produced with about 500-Mev energy in the center-of-mass system. Thus the collision of a 30-Bev nucleon with a target nucleon would seem to be, on the average, not 100 percent inelastic. A rough determination has been made of the mean free path for penetrating shower production versus energy for the secondary π-mesons. The cross section for further meson production is found to be about 0.1 geometric in lead at 1 Bev rising to geometric for energies greater than 4 Bev. The secondaries produced in meson-nucleon collisions seem to be distributed uniformly in the center-of-mass system. Arguments are presented to show that less than 15 percent of the secondaries of penetrating showers are heavy mesons. (auth)

2586

THE ANGULAR CORRELATION OF MESONS PRODUCED IN INELASTIC MESON-NUCLEON COLLISIONS. J. S. Kovacs (Indiana Univ., Bloomington). Phys. Rev. 93, 252 (1954) Jan. 1.

Results are presented from a calculation using scalar theory for the angular distribution of the two mesons in the final state resulting from high-energy inelastic meson-nucleon collisions. Both extreme cases of strong meson-nucleon with weak meson-meson coupling and weak meson-nucleon with strong meson-meson coupling are considered. (L.M.T.)

2587

OBSERVATION OF A NEW DECAY MODE OR A HEAVY MESON. J. Crussard, M. F. Kaplon, J. Klarmann, and J. H. Noon (Univ. of Rochester, New York). Phys. Rev. 93, 253(1954) Jan. 1.

By tracing back the trajectories of π mesons arising from decay of heavy unstable particles in stacked emulsions and determining the mass of the heavy primary particle, an event $\tau \rightarrow \pi^+ + 2\pi^\circ$ is postulated. (L.M.T.)

2588

MESON PRODUCTION IN HIGH-ENERGY NUCLEON-NUCLEON COLLISIONS. William L. Kraushaar and Lawrence J. Marks (Mass. Inst. of Tech., Cambridge). Phys. Rev. 93, 326-30(1954) Jan. 15.

A model for meson production in high-energy nucleon-nucleon collisions similar to a model suggested by Takagi is discussed. It is assumed that the primary collisions result in the formation of two highly excited nucleons which decay as free particles. Forward and backward center-of-mass collimation is a natural consequence. Angular momentum is discussed and treated quantitatively by means of thermodynamic arguments similar to those used by Fermi. The model implies a tendency for the mesons to be emitted in a plane. The multiplicities predicted are larger than those predicted from the Fermi model and depend upon an additional parameter related to angular momentum. (auth)

MOLECULAR PROPERTIES

2589

Brookhaven National Lab.

VIBRATIONAL ENERGY LEVEL SPLITTING AND OPTICAL ISOMERISM IN PYRAMIDAL MOLECULES OF THE TYPE XY_3. Ralph E. Weston, Jr. [1953]. 21p. (BNL-1697)

The vibrational energy level splittings and rates of racemization have been estimated for several pyramidal molecules with N, P, As, Sb, and S as central atoms. The calculations are based on a potential energy function, which is derived from known vibrational frequencies and molecular dimensions. It is concluded that energy level splittings for all molecules but ammonia are too small for observation and that optically active compounds of arsenic, antimony, and sulfur should be stable towards racemization at room temperature. (auth)

2590

Ames Lab.

MOLECULAR CALCULATIONS. 1. AN LCAO MO SELF-CONSISTENT FIELD TREATMENT OF THE GROUND STATE OF H_2O. Frank O. Ellison and Harrison Shull. [2-12-54]. 39p. Contract [W-7405-eng-82]. (ISC-459)

2591

THEORY OF INTERMOLECULAR POTENTIAL AND SECOND VIRIAL COEFFICIENT OF HYDROGEN AT LOW TEMPERATURE. Masataka Mizushima (Duke Univ., Durham, N. C.) and Kimio Ohno and Akiko Ohno (Univ. of Tokyo, Japan). J. Chem. Phys. 21, 2107-14(1953) Dec.

The intermolecular potential between H molecules is calculated, taking into account its dependence on the relative orientation of the molecules. Assuming that the rotational quantum number of each molecule is a good quantum number throughout collision at low temperature, the matrix elements of the repulsive short-range intermolecular potential and the London potential are calculated. If the intermolecular potential depends on the relative orientation of colliding molecules, the resulting matrix element depends on the rotational quantum number. Thus it is pointed out that the second virial coefficient of ordinary H (which is, at low temperature, a mixture of 75% of J = 1 molecules and 25% of J = 0 molecules, where J is the rotational quantum number), and pure para hydrogen (which consists of only J = 0 molecules at low temperature) must be different, even if there were no statistical effect. The virial coefficient is calculated for very low temperature by solving the Schroedinger equation numerically. (auth)

2592

ISOTOPE EFFECT ON THE DIPOLE MOMENTS OF DIATOMIC MOLECULES. Aubrey P. Altshuller (1911 Clover Ave., Cleveland, Ohio). J. Chem. Phys. 21, 2241-2(1953) Dec.

A modification of Bell's treatment (Trans. Faraday Soc. 31, 1345(1935)) of the effect of isotopic substitution on the dipole moments of diatomic molecules is proposed. The more general equation developed is then applied to several isotopic alkali halides. (J.A.G.)

NEUTRONS

2593

Radiation Lab., Univ. of Calif., Berkeley

THEORETICAL STUDY OF A SOURCE OF INTERMEDIATE ENERGY NEUTRONS. Sidney A. Biudman. Jan. 7, 1954. 44p. Contract No. W-7405-eng-48. (UCRL-2449)

An analysis is made of a proposal to obtain neutrons of 15 to 25 kev energy by moderating fast neutrons in Al and then reflecting off Ti. The fluxes calculated do not significantly exceed those obtainable from a standard Sb–Be photoneutron source. Two appendices treat aspects of the transport of neutrons through a slab of finite thickness. (auth)

NUCLEAR PHYSICS

2594

Nuclear Physics Labs., Columbia Univ.

PROGRESS REPORT FOR APRIL, MAY, JUNE 1953 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. 31p. Contract AT-30-1 GEN-72. (CU-130)

Slow neutron transmission measurements on Na confirm

the presence of a level near 3 kev. The region between 0.1 and 200 ev is matched by $\sigma = 3.06 + 0.12\ E^{-0.5}$ barns. Slow neutron transmission measurements on thick Ag were made between the 5- and 16-ev levels to compare with results from scattering measurements. The radial distribution of the magnetic field between the dees of the 36-in. cyclotron was determined. The effect of the variation of resonance parameters for the 16.6-ev level in Ag is reported. The preparation and performance of neutron reflecting mirrors for determining coherent scattering cross sections are discussed. Nuclear density functions were computed for Pb, Sb, Ag, Cu, Ca, Mg, and C, using harmonic-oscillator wave functions and building up the nuclei according to the shell model. Brief note is made of U_3O_8 electroplating and the use of plastics as tubing materials. The desirable characteristics of a multichannel pulse amplitude analysis system and the performance of a continuously variable Hg delay line are briefly discussed. The solenoid spectrometer was modified for β-γ coincidence measurements and tested with Au^{198}. The maximum possible height of the r-f cavity was determined. Provision was made for introducing and removing gas from the cavity and for fine timing. The effect of using a Cu disk to simulate the Cu^{64} source was measured. The angular correlation between recoil ions and β particles from He^6 above 0.5 Mev was measured. Tests were conducted on cores of NAP ferrite 3A and 4C in comparison with Si steel cores in pulse transformers. Results showed ferrite cores to be superior to the Si steel core. A small pulse transformer was built to operate the source at a high d-c potential. (For preceding period see CU-129.) (auth)

2595

THE THEORY OF THE DEUTERON STRIPPING REACTIONS. N. C. Francis (Indiana Univ., Bloomington) and K. M. Watson (Univ. of Wisconsin, Madison). Phys. Rev. 93, 313-17(1954) Jan. 15.

The deuteron stripping reactions are analyzed from the point of view of the many-body problem. A rigorous formal solution is given. From this it is shown how assumptions less restricted than Butler's can be employed to reduce the many-body interactions to those of a deuteron moving in a potential well. At this point, the relation to previous theories is readily established. The present theory might be termed "the optical model" of the stripping reactions and represents a considerable generalization of current theories. (auth)

NUCLEAR PROPERTIES

2596

Los Alamos Scientific Lab.

NON-UNIFORM NUCLEAR CHARGE DISTRIBUTIONS AND MEASUREMENTS OF NUCLEAR ELECTRICAL RADIUS. Kenneth W. Ford, Indiana Univ. and David L. Hill. Los Alamos Scientific Lab. [1954]. 25p. Contract [W-7405-eng-36]. (AECU-2819)

The dependence of three long wave length electronic effects, and of the nuclear coulomb energy on the size and shape of the electrical charge distribution in heavy nuclei is reviewed in order to consider the possibility of non-uniform charge distribution. The nuclear coulomb energy sheds no light on the shape of the nuclear charge distribution because of its inherent insensitivity to change of shape. Medium-energy electron scattering results, coupled with μ-mesonic x-ray results, will in principle be able to delineate shapes. Present evidence from this source suggests a charge distribution nearly uniform or somewhat peaked toward the edge of the nucleus. (auth)

2597

Livermore Research Lab., Calif. Research and Development Co.

NUCLEAR RADII AND TRANSPARENCIES FROM INELASTIC CROSS-SECTION MEASUREMENTS. W. Birnbaum, W. E. Crandall, and L. Schecter, Livermore Research Lab., Calif. Research and Development Co. and G. P. Millburn, Radiation Lab., Univ. of Calif., Berkeley. Jan. 1954. 81p. Contract AT(11-1)-74. (LRL-85)

Inelastic cross sections for high-energy protons, deuterons, He^3 particles, and α particles accelerated in the 184-in. cyclotron were measured by an attenuation technique. All the cross sections vary as the square of the nuclear radius and indicate that if the nucleus has a fringe, it increases as $A^{1/3}$. The derived value of the nuclear radius constant depends on the nuclear model and the particular bombarding particle and varies from (1.3 to 2.0) $\times$ 10^{-13} cm. Deuteron stripping cross sections were derived and found to vary approximately as the square root of the mass number A. (auth)

2598

Duke Univ.

RADIOFREQUENCY SPECTROSCOPY. PROGRESS REPORT NO. 6 [FOR] AUGUST 1, 1953–OCTOBER 31, 1953. 26p. Contract DA-36-034-ORD-1233. (NP-5017)

Separate abstracts have been prepared on two sections of this report. (For preceding period see NP-4876.) (C.H.)

2599

Duke Univ.

NUCLEAR QUADRUPOLE RESONANCE OF THE STABLE GALLIUM ISOTOPES. H. G. Dehmelt. p.9-11 of RADIOFREQUENCY SPECTROSCOPY. PROGRESS REPORT NO. 6 [FOR] AUGUST 1, 1953–OCTOBER 31, 1953. 3p. Contract DA-36-034-ORD-1233. (NP-5017(p.9-11))

Nuclear quadrupole resonance in the spectral region from 9.3 to 36.8 Mc/sec has been investigated in a sample of about 10 g $GaCl_3$. A recording superregenerative spectrometer was used, employing 30-cps Zeeman modulation. All together eight absorption lines were observed whose frequencies are presented in tabular form. As the spins of the Ga isotopes $Ga^{69,71}$ as well as the chlorine isotopes $Cl^{35,37}$ are $^3/_2$, only the one transition $m = \pm^1/_2 \rightleftharpoons ^3/_2$ is expected for each of the four nuclear species. With the help of the known ratio of the Cl quadrupole moments, $Q_{Cl^{35}}/Q_{Cl^{37}} = 1.26878 \pm 0.00015$, six of the observed lines could be grouped into three pairs corresponding to three different lattice sites for the Cl atoms. The two remaining lines, whose frequency ratio is found to be the same as the ratio of the Ga quadrupole moments, $Q_{Ga^{69}}/Q_{Ga^{71}} = 1.5868 \pm 0.0004$, known from atomic beam experiments, were assigned to the Ga isotopes. (auth)

2600

Duke Univ.

NUCLEAR QUADRUPOLE RESONANCE OF Hg^{201}. H. G. Dehmelt, H. G. Robinson, and Walter Gordy. p.12-24 of RADIOFREQUENCY SPECTROSCOPY. PROGRESS REPORT NO. 6 [FOR] AUGUST 1, 1953–OCTOBER 31, 1953. 13p. Contract DA-36-034-ORD-1233. (NP-5017(p.12-24))

Five nuclear quadrupole resonance lines have been observed in polycrystalline $HgCl_2$. From their frequencies the magnitudes of the quadrupole coupling constants eQq_{zz} $(Hg^{201}) = 720$ Mc/sec and $eQq_{zz}(Cl^{35}) = 44.3$ Mc/sec were evaluated. Comparison of the Cl^{35} coupling constant in $HgCl_2$ with that known for the free Cl atom from atomic beam experiments facilitates the discussion of the molecular structure. A quadrupole coupling constant of 1000 Mc/sec per p electron in the 6s6p configuration of free Hg is deduced from the Hg^{201} coupling in $HgCl_2$. This value can be directly compared with the coupling of the 6s6p $^2P_2$ HgI term, $eQq_{zz} = (Hg^{201}, p_z) = 780$ Mc/sec, which is equivalent to the value of the quadrupole parameter $B = 0.27 \times 10^{-3}$ cm^{-1} known from optical hfs investigations. Whereas a standard analysis of the hfs of the $^2P_2$ term had given $Q(Hg^{201}) = 0.5 \times 10^{-24}$ cm^2, a discrepant value $Q(Hg^{201}) = 0.2 \times 10^{-24}$ cm^2 was

obtained from the $^1P_1$ term. The results yield a value 0.6×10^{-24} cm^2 in fair agreement with the larger value found for the $^2P_2$ term. (auth)

2601

Radiation Lab., Univ. of Calif., Berkeley

EXCITATION FUNCTIONS OF BISMUTH (thesis). Elmer Lewis Kelly. Dec. 27, 1950. 74p. Contract W-7405-eng-48. (UCRL-1044)

Excitation functions of Bi are studied by α and proton reactions. $(\alpha,2n)$ and $(\alpha,3n)$ cross section experiments near 25 Mev produced 0.25-sec At^{212}, but no excitation function was measured. The nuclear radius constant r_0 was found to have the value 1.43×10^{-13} cm for Bi. Reaction mechanisms producing Po^{210}, At^{210}, At^{211}, and Po^{209} are discussed. (K.S.)

2602

Radiation Lab., Univ. of Calif., Berkeley

EXPERIMENTAL SEARCH FOR A COHERENT NUCLEAR STRUCTURE. Boris Ragent and W. I. Linlor. Jan. 12, 1954. 5p. Contract No. W-7405-eng-48. (UCRL-2457)

Unexpected results in the total neutron cross section of Pb, in the region 30 to 150 Mev, were studied by testing a theory due to Jastrow wherein a coherent structural phenomenon within the nucleus gives rise to a coherent scattering similar to Bragg scattering. Experiments with the proton beam of the 184-in. cyclotron yielded negative results, indicating that some other explanation than a coherent structural effect is needed to explain the variation in the total neutron cross section for Pb. (K.S.)

2603

DISPLACEMENT IN AN ELECTROSTATIC FIELD OF MAGNETO-ELECTRONIC SPIRALS. Louis Cartan. Translated from J. phys. radium 5, 257-61(1934). 9p. Available from Associated Technical Services (Trans. No. 52E2F), East Orange, N. J. (AEC-tr-1769)

The displacement undergone by magneto-electronic spirals in an inhomogeneous field is known. If the field has radial symmetry, for example, the particles twist into a trochoid between two concentric circles centered on the axis of symmetry. The effect of an electric field of whatever magnitude and direction on these spirals was calculated. If v_0 is the velocity of the particles ($\beta_0 = v_0/c$), $(\Delta H)_r$ the variation of the magnetic field along the radius of an elementary spiral, h the strength of the electric field which makes an angle θ with the circle of uniform field, then the differential equation of the mean trajectory of the spirals in polar co-ordinates is

$$R \frac{d\varphi}{dR} = \frac{\beta_0(\Delta H)_r - 2h \sin \theta}{2h \cos \theta}.$$

The magnitudes of the terrestrial fields are such as to verify the conditions of validity of the calculation. (auth)

2604

EXCITATION OF NUCLEI BY THE COULOMB FIELD OF CHARGED PARTICLES. (Vozbuzhdenie Yader Kulonovskim Polem Zaryazhennykh Chastits). K. A. Ter-Martirosyan. Translated by J. W. Butler from Zhur. Eksptl'. i Teoret. Fiz. 22, 284-96(1952). 19p. (NRL-Trans-457)

An abstract of this article appears in Nuclear Science Abstracts as NSA 7-1238.

2605

INVESTIGATION OF THE NUCLEAR ISOMERISM OF Zn^{69}, Nb^{95}, AND Ba^{137}. V. M. Dolishnyuk, G. M. Drabkin, V. I. Orlov, and L. I. Rusinov. Translated from Doklady Akad. Nauk S.S.S.R. 92, 1141-4(1953). 4p. (NSF-tr-229)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-1682.

2606

A NOTE ON THE RATIO OF THE QUADRUPOLE MOMENTS OF Li^6 AND Li^7. N. G. Cranna (Univ. of British Columbia, Vancouver, Canada). Can. J. Phys. 31, 1185-6(1953) Nov.

The ratio of the quadrupole moments of Li^6 and Li^7 is given as $(1.9 \pm 0.1) \times 10^{-2}$. (K.S.)

2607

NUCLEAR MAGNETIC RESONANCE IN METALS. II. TEMPERATURE DEPENDENCE OF THE RESONANCE SHIFTS. B. R. McGarvey and H. S. Gutowsky (Univ. of Illinois, Urbana). J. Chem. Phys. 21, 2114-19(1953) Dec.

The temperature dependence of the nuclear-resonance shift in metals has been investigated in Li, Na, Rb, Cs, and Ga. The resonance shifts were found to change by no more than 5 to 6% over temperature ranges of 200°, including the melting point. For Na, the observed temperature dependence of the resonance shift is correlated directly with the volume dependence predicted theoretically for the mass magnetic susceptibility due to the conduction electrons. In the other metals, effects appear which are related apparently to the volume dependence of the wave functions for electrons at the top of the conduction band. The room-temperature resonance shifts of Sn^{117} and Sn^{119} and the temperature dependence of the Rb^{87} line width are also reported for the metals. The resonance shift of Sn is 0.705×10^{-2}. The estimation of activation energies for self-diffusion from the temperature dependence of the line widths is discussed. (auth)

2608

THE PROTON MAGNETIC RESONANCE IN NATURAL RUBBER. H. S. Gutowsky and L. H. Meyer (Univ. of Illinois, Urbana). J. Chem. Phys. 21, 2122-6(1953) Dec.

The proton magnetic resonance has been observed in natural rubber from liquid N_2 temperature to room temperature. The absorption line widths show two regions to change. With rising temperature, the first change in width starts at about 155°K, and it is assigned to the onset of segmental motions. The latter change coincides with the second-order transitions observed in various physical properties and provides a direct confirmation of the cause of the transition. Samples cured 30, 60, and 90 min were investigated, and it was found that curing has a larger effect on the line-width changes at lower temperature than at higher temperature. The inferred greater effect of curing upon CH_3 group motions than upon segmental motions suggests that cross linking is not the primary mechanism of vulcanization. Rubber stretched 70% was found to have the same resonance absorption as unstretched samples. (auth)

2609

NUCLEAR QUADRUPOLE RESONANCE OF IODINE IN MOLECULAR SOLIDS. S. Kojima, K. Tsukada, S. Ogawa, and A. Shimauchi (Tokyo Univ. of Education, Japan). J. Chem. Phys. 21, 2237-8(1953) Dec.

The resonance frequencies of the I nuclei in 4 alkyl iodides, monoiodoacetic acid, as I_3, and SnI_3 were measured with two super-regenerative detectors, one working in the frequency range between 150 and 350 Mc/sec and the other between 300 and 700 Mc/sec. The observed resonance frequencies, coupling constants, and asymmetry parameters at the liquid-air temperature are tabulated. (J.A.G.)

2610

THE PRESENT STATUS OF ELEMENTS 85 AND 87. Earl K. Hyde (Radiation Lab., Univ. of Calif., Berkeley). J. Phys. Chem. 58, 21-6(1954) Jan.

Out present knowledge of elements 85 and 87 is reviewed with considerable emphasis on their nuclear properties. From recent studies, primarily of cyclotron-produced activities, we have reliable information on 7 isotopes of Fr and more than 14 isotopes of At. The longest lived forms are the 21-min AcK and the 8.3-hr At^{210}, respectively. From consideration of α- and β-decay systematics it can be concluded that there is no possibility of the existence of

long lived forms. Short lived isotopes can and do exist in naturally occurring radioactive ores and some recent work in this field is discussed. A brief review of the principal chemical properties is included. (auth)

2611
MEASUREMENT OF THE AGREEMENT OF THE THERMAL NEUTRON FISSION CROSS SECTIONS OF Pu^{239} AND NATURAL URANIUM. Antoine Lévêque, René Cohen, and Eugène Cotton (Centre d'Études Nucléaires, Gif-sur-Yvette (Seine-et-Oise), France). J. phys. radium 15, 101-8(1954) Feb. (In French)

The thermal neutron cross sections of Pu^{239} and natural U were determined with the aid of two different experimental arrangements for a flux of thermal neutrons issuing from a radial canal of the heavy water pile at Châtillon and found to equal 205.7 ± 4. The significance of this result is discussed, and the result compared with the cross section values published by others. (tr-auth)

2612
NUCLEAR SPIN OF $^{239}_{94}Pu$. Marcha van den Berg, P. F. A. Klinkenberg (Univ. of Amsterdam, Netherlands) and Pierre Regnaut, (Commissariat à l'énergie atomique, Paris, France). Physica 20, 37-8(1954) Jan. (In English)

The optical spectrum of Pu^{239} was excited in a hollow cathode tube. The region 6500 to 4000 A was examined under high resolution, and narrow doublet lines were observed. The splitting was interpreted as magnetic hfs. Since the J values in the PuI spectrum are integers and even a 0-1 transition would show 3 components if the nuclear spin were $\geq 3/2$, the Pu^{239} nuclide has a ground state spin $I = 1/2$. (J.S.R.)

2613
THE SECOND-FORBIDDEN BETA SPECTRA OF Co^{60} AND Sc^{46}. G. L. Keister and F. H. Schmidt (Univ. of Washington, Seattle). Phys. Rev. 93, 140-5(1954) Jan. 1.

A hitherto unreported high-energy beta-ray component has been found in the decay of Co^{60}. Its abundance and end point are (0.15 ± 0.01) percent and 1.48 ± 0.02 Mev, respectively. The abundance and end point of the Sc^{46} high-energy component are (0.096 ± 0.01) percent and 1.25 ± 0.02 Mev, respectively. Both the Co^{60} and Sc^{46} spectra can be fitted with the C_2T correction factor corresponding to $\Delta J = 2$ and no parity change. The log ft values, uncorrected for the forbidden shape, are: $Co^{60} = 12.6$, and $Sc^{46} = 11.3$. The decay schemes are discussed. (auth)

2614
NUCLEAR SPINS AND BAND SPECTRA OF THE SELENIUM ISOTOPES. Sumner P. Davis (Univ. of California, Berkley). Phys. Rev. 93, 159-62(1954) Jan. 1.

An investigation of the rotational structure of the $^1\Sigma_u^+ - ^1\Sigma_g^+$ band system of Se_2 in the region 3700–3815A, using separated isotopes of selenium, has made possible the assignment of $I = 1/2$ to the nucleus Se^{77}, and the confirmation of $I = 0$ for Se^{78} and Se^{80}. At the same time a number of new facts regarding the predissociation and the rotational constants of the Se_2 molecules are established. (auth)

2615
MEASURE OF K-SHELL INTERNAL CONVERSION COEFFICIENTS WITH A COINCIDENCE SCINTILLATION SPECTROMETER. F. K. McGowan (Oak Ridge National Lab., Tennessee). Phys. Rev. 93, 163-72(1954) Jan. 1.

The K-shall internal conversion coefficients of gamma rays from Te^{123}, Sm^{153}, Hf^{181}, and Os^{191} have been measured using a coincidence scintillation spectrometer employing NaI and anthracene phosphors as detectors. In several cases an unambiguous classification of the transition as to multipole order and character is possible. The results indicate that the 159-kev gamma ray from Te^{123} is predominantly M1, the 70-kev gamma ray from Sm^{153} is a mixture of E2 + M1, the 132-kev gamma ray from Hf^{181} is predominantly E2, the 135-kev gamma ray from Hf^{181} is predominantly M1, the 345-kev and 480-kev gamma rays from Hf^{181} are a mixture of either E2 + M1 or E1 + M2, and the 129-kev gamma ray from Os^{191} is a mixture of either E2 + M1 or E1 + M2. (auth)

2616
THE NUCLEAR MAGNETIC MOMENTS OF K^{41}, Y^{87}, Ag^{107}, AND Ag^{109}. E. Brun, J. Oeser, H. H. Staub, and C. G. Telschow (Zürich Univ., Switzerland). Phys. Rev. 93, 172-3(1954) Jan. 1.

The gyromagnetic ratios of K^{41}, Y^{89}, Ag^{107}, and Ag^{109} have been measured by nuclear induction technique. With the known spin values the magnetic moments without diamagnetic corrections are:

$$\mu_{41} = -0.21453 \pm 0.00003 \text{ nm},$$
$$\mu_{89} = -0.136825 \pm 0.000004 \text{ nm},$$
$$\mu_{107} = -0.113014 \pm 0.000004 \text{ nm},$$
$$\mu_{109} = -0.129924 \pm 0.000004 \text{ nm}.$$

In metallic silver a paramagnetic shift of 0.53 percent is observed. (auth)

2617
THE MAGNETIC MOMENTS OF Ag^{107} AND Ag^{109} AND THE HYPERFINE STRUCTURE ANOMALY. P. B. Sogo and C. D. Jeffries (Univ. of California, Berkeley). Phys. Rev. 93, 174-5(1954) Jan. 1.

The nuclear magnetic moments of Ag^{107} and Ag^{109} are measured by nuclear induction and found to be $\mu(Ag^{107}) = -(0.113042 \pm 0.000013)$ nm and $\mu(Ag^{109}) = (0.12995 \pm 0.000013)$ nm. The ratio of the moments is measured to be $\mu(Ag^{107})/\mu(Ag^{109}) = 0.86985 \pm 0.00001$; this ratio combined with the ratio of the hfs separations as measured by Wessel and Lew yields for the hfs anomaly $\Delta = -(0.412 \pm 0.006)$ percent, which is compared to calculated values. (auth)

2618
SEARCH FOR THE $p_{1/2}$ ISOMERIC STATE IN Tc^{101} and IDENTIFICATION OF ENERGY LEVELS. Donald R. Wiles (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 93, 181-2(1954) Jan. 1.

Careful half-life measurements by various methods give 14.6 ± 0.1 min for Mo^{101} and 14.3 ± 0.1 min for Tc^{101}. Measurements of the β and γ energies give substantially the same values as previous workers report. Spin and parity assignments have been made to all levels observed. A search was made for the possible existence of isomeric $p_{1/2}$ Tc^{101m}, with no evidence for measurable half-life. The evidence is that this state lies above the $7/2+$ state, and decays to it by an E3 transition with short half-life rather than by M4 transition to the $g_{9/2}$ state. (auth)

2619
THERMAL NEUTRON RESONANCE OF Sm. A. W. McReynolds and E. Andersen (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). Phys. Rev. 93, 195-6(1954) Jan. 1.

The total neutron cross section of Sm has been measured over the energy range 0.005 to 0.18 ev using a crystal spectrometer. Agreement with a Breit-Wigner one-level resonance. (auth)

2620
INELASTIC SCATTERING OF NEUTRONS NEAR THRESHOLD. B. Margolis (Atomic Energy of Canada Limited, Chalk River). Phys. Rev. 93, 204-7(1954) Jan. 1.

Using the compound nucleus model, and assuming a statistical distribution of levels of the compound state, the inelastic neutron scattering cross sections for excitation of metastable states of Cd^{111} and In^{115} are calculated. The energy range just above threshold is considered. The sensi-

tivity of the cross sections to the spin and parity of the metastable state is demonstrated in the case of Cd^{111}. Comparison is made with experiment, and the calculations are seen to be useful in learning about spins and parities of excited states of nuclei. (auth)

2621

SOME p- AND d-SHELL NUCLEI IN INTERMEDIATE COUPLING. G. E. Tauber and Ta-You Wu (National Research Council, Ottawa, Canada). Phys. Rev. 93, 295-301 (1954) Jan. 15.

The theory of intermediate coupling has been applied to nuclei having either two particles or "holes" in the first p or d shell, such as He^6, Li^6, N^{14}, C^{14}, O^{18}, F^{18}, Ca^{38}, and A^{38}. A central nucleon-nucleon interaction of the form $(mP + nQ)V(r_{12})$, where P denotes the Majorana and Q the Bartlett operator, is assumed and calculations have been carried out for the exponential, Yukawa, and Gaussian types of potential $V(r_{12})$ with various "ranges." The coefficients m, n and the constants of the potential $V(r_{12})$ have been estimated from data for two free nucleons. The secular equations have been solved, and thus the degeneracy in the energy levels in the two extreme types of couplings has been removed. The energy levels of various spins for the various types of interactions and "ranges" have been plotted against the spin-orbit interaction parameter ζ. The range of ζ giving the correct spin for the ground state is found to depend on the type and "range" of $V(r_{12})$. The magnetic moments for these nuclei can also be obtained with the appropriate wave function for intermediate coupling. It is found that in the case of Li^6, a Yukawa potential having a "range" of about 1.0×10^{-3} cm accounts for both known excited states and gives a magnetic moment of $0.87_{\mu N}$. For N^{14}, the calculated magnetic moment is $0.36_{\mu N}$. (auth)

2622

THE TENDENCY FOR POSITIVE NUCLEAR QUADRUPOLE MOMENTS. S. A. Moszkowski and C. H. Townes (Columbia Univ., New York). Phys. Rev. 93, 306-12(1954) Jan. 15.

An examination of the signs of nuclear quadrupole moments and of the nuclear states which produce them affords fairly striking evidence that a positive quadrupole moment tends to lower the energy of a nuclear state. For nuclei containing several particles outside of closed shells the shell model often does not uniquely specify the sign of the quadrupole moment. The ground states of such nuclei are, however, known to have positive quadrupole moments in the great majority of cases. Additional evidence for this tendency is provided by a discussion of: (a) the ground states of Cu, Ga, As, Br, and Rb; (b) the exceptions to the single-particle version of the shell model, Na^{23}, Mn^{55}, Se^{79}, Eu^{153}, and Yb^{173}; and (c) the spins of ground states of odd-odd N = Z nuclei. The favoring of positive quadrupole moments appears to be accounted for by electrostatic and other known forces in conjunction with large core deformations. It may, perhaps, also be influenced by tensor forces. (auth)

2623

NUCLEON ISOBARS IN INTERMEDIATE COUPLING. Francis H. Harlow and Boris A. Jacobsohn, (Univ. of Washington, Seattle). Phys. Rev. 93, 333-40(1954) Jan. 15.

The energies of excited states of nucleons are calculated for the symmetric pseudoscalar meson theory with a fixed, extended source. A version of the Tomonaga method, which is shown to be approximately correct in the limit of strong coupling, is used. The calculation is carried out for moderate coupling by using trial functions with 0, 1, 2, and 3 mesons. Numerical results are presented for a source of the Yukawa shape. For coupling stronger than a critical strength which varies with state and source size, isobars are found for angular momenta $\frac{1}{2}$, $\frac{3}{2}$ and for isotopic spins $\frac{1}{2}$, $\frac{3}{2}$. The $(\frac{3}{2}, \frac{3}{2})$ state always lies lowest in energy. A very large source ($\sim \frac{1}{2}$ the meson Compton wavelength) yields a $(\frac{3}{2}, \frac{3}{2})$ isobar at ~ 350 to 400 Mev excitation, and a degenerate $(\frac{3}{2}, \frac{1}{2})$ and $(\frac{1}{2}, \frac{3}{2})$ pair at ≥ 500 Mev. Other isobars lie considerably higher. Smaller sources correspond to higher excitation energies in this range of coupling strength. (auth)

2624

CALCULATION OF THE MAGNETIC MOMENTS, QUADRUPOLE MOMENT, AND EXCITED STATES OF A LIGHT NUCLEUS. R. Schulten (Max-Planck Institut für Physik, Göttingen, Germany). Z. Naturforsch. a8, 759-75(1953) Dec. (In German)

The states of nuclei with 2P shells were described by the energetic convenient combination of all approximation functions which were built up from the oscillatory eigenfunctions of simple-particle models by consideration of a spin-orbit coupling. With the help of the functions of the nuclear state its magnetic moment, quadrupole moment, and a simple excited state were calculated. (tr-auth)

NUCLEAR REACTORS

*2625

Los Alamos Scientific Lab.

HEAT TRANSFER AND THERMAL STRESSES IN NUCLEAR REACTOR SHELLS. Franklin P. Durham. Sept. 1953. Decl. Feb. 2, 1954. 20p. Contract W-7405-eng-36. (LA-1590).

A method is presented for determining heat transfer rates and thermal stresses from the gamma-ray energy absorption of nuclear reactor shells for plane, cylindrical, and spherical geometries. Criteria for minimizing thermal stresses are developed, along with the corresponding external cooling rates necessary to minimize the thermal stress. Design charts are presented for rapid determination of approximate thermal stresses and heat transfer rates, along with a numerical example illustrating the use of the charts. (auth)

NUCLEAR TRANSFORMATION

2626

Los Alamos Scientific Lab.

THE PICKUP REACTIONS $B^{10}(n,d)Be^9$ FOR 14-MEV NEUTRONS. F. L. Ribe and J. D. Seagrave. 29p. Contract W-7405-eng-36. (AECU-2807)

Measurements have been made of the yields and angular distributions of deuterons resulting from the bombardment of B^{10} by 14-Mev neutrons. The spectrum of charged reaction products was measured by means of a coincidence-telescope spectrometer consisting of two proportional counters and a thin NaI scintillator. The telescope was rotated to obtain measurements at various angles. Deuterons corresponding to the ground state and 2.43-Mev excited state of Be^9 were identified by measurements of both their energy and dE/dx values. The ground-state angular distribution was found to match the expected Butler inverse-stripping curve for $l_p = 1$. The Butler analysis for the excited-state deuterons also gave $l_p = 1$, corresponding to odd parity and spin $\frac{3}{2}$, $\frac{5}{2}$, $\frac{7}{2}$, or $\frac{9}{2}$ for the first excited state of Be^9. In particular, the spin value $\frac{1}{2}$, to be expected from the L-S coupling model, is excluded. The cross sections, integrated from zero to 90° (center-of-mass), are 21 ± 3 and 16 ± 2 mb, respectively, for the ground- and excited-state reactions. (auth)

2627

Argonne National Lab.

A TABULATION OF NEUTRON ENERGIES FROM MONOERGIC PROTONS ON LITHIUM. A. S. Langsdorf, Jr., J. E. Monahan, and W. A. Reardon. Jan. 1954. 47p. Contract W-31-109-eng-38. (ANL-5219)

Elaborate tables of data are presented of neutron energies from the $Li^7(p,n)Be^7$ reaction, as a function of monoergic proton energies in the range 1 to 3 Mev. Neutron energies are given to an accuracy of 0.01% or 10 ev, whichever is larger. Particular attention was given to relativistic considerations, in addition to sources of shift and spread in the neutron energies. The results are applicable to other two-body reactions involving neutrons or charged particles. The tabular data include reactions to the 430-kev and ground state of Be^7, giving values of $z\beta_3$ and $z\beta_2$ and neutron energies at θ = 0, 60, and 120°. (K.S.)

2628
Brookhaven National Lab.
NEUTRON CAPTURE GAMMA RAY SPECTRA. Melvin Reier. Nov. 1, 1953. 9p. (BNL-1667)

A series of measurements was performed to investigate the gamma-ray spectra, in the region from about 100 kev to about 3 Mev, resulting from the capture of thermal neutrons in a number of elements. The purpose of the experiment was to supplement the high-energy capture gamma-ray data in order to remove some of the ambiguities from the proposed energy level schemes and to obtain information for the Shielding Group of Brookhaven National Lab. on elements normally found in reactors. (auth)

2629
Hanford Works
THE SPONTANEOUS FISSION OF PLUTONIUM-240. E. M. Kinderman. Apr. 15, 1953. Decl. Feb. 25, 1954. 8p. Contract W-31-109-Eng-52. (HW-27660)

The spontaneous fission rate of Pu^{240} has been redetermined and found to be 1.51×10^6 events/g/hr. (auth)

2630
Joint Establishment for Nuclear Energy Research (Norway)
(n,α) YIELDS FOR PILE NEUTRONS IN ELEMENTS OF MEDIUM AND HIGH ATOMIC NUMBER. E. Saeland, M. Lykaas, and K. Samsahl. 1954. 12p. (JENER-23)

The reaction $Zn^{68}(n,\alpha)Ni^{65}$ with fast pile neutrons has been examined. The average fast neutron cross section $\bar{\sigma}$ was found to be 0.105% of the cross section for the reaction $P^{31}(n,p)Si^{31}$ which was used as a reference. If the latter had a value of 0.019 b, the result for the cross section of the reaction $Zn^{68}(n,\alpha)Ni^{65}$ would be $\bar{\sigma} = 2.0 \times 10^{-5}$ b. The "effective energy" of this reaction with fission neutrons was calculated to be 11.0 Mev. (auth)

2631
Livermore Research Lab., Calif. Research and Development Co.
EXCITATION FUNCTION FOR Na-22 FROM DEUTERONS ON ALUMINUM. S. O. Ring and L. M. Litz. Mar. 1954. 7p. Contract AT(11-1)-74. (LRL-108)

The cross section for the reaction $Al^{27}(d,d\alpha n)Na^{22}$ has been determined as a function of D energy in the energy range from 30 to 190 Mev. This reaction may be used for monitoring a high-energy deuteron beam. (auth)

2632
Princeton Univ.
NEUTRONS FROM THE PROTON BOMBARDMENT OF N^{14}. Fay Ajzenberg, Boston Univ. and Laboratory for Nuclear Science, Mass. Inst. of Tech.; and Wolfgang Franzen, Princeton Univ. [Dec. 20, 1953]. 10p. Contract [AT (30-1)-937]. (NYO-6413)

The $N^{14}(p,n)O^{14}$ reaction has been investigated at 30, 60, and 150° by the method of proton recoils in thick nuclear emulsions. The energy of the incident protons was 17.3 ± 0.1 Mev, and the thickness of the melamine target was 0.2 Mev. The results indicate a ground-state Q value of −6.03 ± 0.2 Mev, yielding a mass defect for O^{14} of 12.2 Mev in good agreement with β-decay results. The data also indicate levels in O^{14} at excitation energies greater than 5.5 Mev. (auth)

2633
Radiation Lab., Univ. of Calif., Berkeley
CROSS SECTIONS FOR PRODUCTION OF π^+-MESONS BY 335-MEV PROTONS AS A FUNCTION OF ATOMIC NUMBER (thesis). Jack Merritt. Nov. 1953. 62p. Contract W-7405-eng-48. (UCRL-2424)

The relative yield of π^+ mesons has been determined for 335-Mev protons on a number of elements. Specifically, the relative differential cross section, $d^2\sigma/dEd\Omega$, was measured at 0° ± 4° in the reaction $p + A \rightarrow \pi^+ + A'$ for the elements D, Be^9, B^{10}, B(natural), C, Al, Cu, Fe, Ag, and Pb. The π^+-meson energies ranged from 35 to 145 Mev. They were counted electronically from signals generated in a trans-stilbene crystal telescope. Identification of the π^+ meson depended upon a fast coincidence in the first two crystals plus the $\pi-\mu$ decay in the third crystal of the telescope. No special isotope effects were observed for the Be^9, B^{10}, B(natural) and C spectra. For C, Al, Fe, Ag, and Pb the relative yield per nucleus can be explained by proton and meson attenuation within the nucleus. The attenuation of protons and mesons is consistent with mean free paths which have been measured in other experiments for protons and mesons in nuclear matter. (auth)

2634
Radiation Lab., Univ. of Calif., Berkeley
ON THE REACTION $p + d \rightarrow \pi^+ + t$. Sidney A. Bludman. Feb. 5, 1954. 9p. (UCRL-2477)

The cross section for this reaction is calculated for three Hulthén deuteron wave functions. A hard core in the deuteron at one-half meson Compton wavelength reduces the total cross section and flattens the angular distribution in the backwards direction in agreement with experiment. (auth)

2635
NEUTRON CAPTURE γ-RAYS FROM HEAVY ODD-CHARGE NUCLEI. G. A. Bartholomew and B. B. Kinsey (Atomic Energy of Canada Ltd., Chalk River, Canada). Can. J. Phys. 31, 1025-50(1953) Nov.

The neutron capture γ spectra of As, Nb, Rh, Ag, In, Sb, Pr, Ta, Au, and Tl are described. The energies and intensities of the strongest high-energy γ rays are given for each element. (auth)

2636
NEUTRON CAPTURE γ-RAYS FROM HEAVY EVEN-CHARGE NUCLEI. B. B. Kinsey and G. A. Bartholomew (Atomic Energy of Canada Ltd., Chalk River, Canada). Can. J. Phys. 31, 1051-1114(1953) Nov.

The neutron capture γ spectra of the elements Se, Sr, Zr, Mo, Cd, Sn, Ba, Sm, Gd, W, Pt, and Hg are described. The energies and intensities of the strongest high-energy γ rays are given for each element. (auth)

2637
PHOTONEUTRON CROSS SECTIONS OF SOME ELEMENTS. J. Goldemberg and Leon Katz (Univ. of Saskatchewan, Saskatoon, Canada). Can. J. Phys. 32, 49-59(1954) Jan.

The neutron yield from photoreactions in nine elements has been measured as a function of the maximum energy of the Univ. of Saskatchewan betatron. Cross sections are given for each of the reactions as calculated from these data. The integrated cross sections are compared with theoretical sum-rule predictions of Levinger and Bethe. The data support the conclusions reached in a preceding paper by Montalbetti, Katz, and Goldemberg. The competition between (γ,n) and (γ,p) reactions in Cr and in Ni is analyzed in the light of these experimental results. Good agreement with statistical theory is obtained in both cases. (auth)

2638
THE PRODUCTION OF Na^{22} BY A (H^3,n) REACTION IN A NUCLEAR REACTOR. L. G. Cook and K. D. Shafer

(Atomic Energy of Canada Limited, Chalk River, Ontario). Can. J. Chem. 32, 94-7(1954) Feb.

The positron emitting Na^{22} of 2.6-year half life has been prepared in a nuclear reactor by the double reaction $Li^6(n,\alpha)H^3$, $Ne^{20}(t,n)Na^{22}$. The over-all yield was 2.3×10^{-7} atoms of Na^{22} per atom of tritium formed. Eleven grams of lithium as aluminum alloy turnings in a neon atmosphere at 200 psi was irradiated for 175 days in a neutron flux of about 4×10^{12} n/cm²/sec. About 380 μc of Na^{22} was obtained in a sodium extract having a specific activity of 10 mc Na^{22}/g of Na^{23}. A specific activity in the curie/g level would be expected from a longer irradiation in the highest flux (6×10^{13} n/cm²/sec) in the NRX reactor. The separation and purification of the sodium proved practicable by paper chromatography or ion exchange; the analyses for trace Li and Na^{23} were carried out by radioactivation. (auth)

2639

CALCULATION OF THE THRESHOLD ENERGY OF A NUCLEAR REACTION AND THEORETICAL ENERGY PREDICTIONS OF (n_{th},α) REACTIONS. Charles N. Martin. Compt. rend. 237, 1671-3(1953) Dec. 21. (In French)

With the aid of a single relation for binding energies, a systematic calculation is presented of exoenergetic (n,α) reactions produced by thermal neutrons in the region A = 20 to 85. A tabulation of E_α predicted for energies ≥1 Mev is given. Interest in these reactions among the heavy elements is emphasized by indications that α emission is predicted for elements between the rare earths and natural emitters. (tr-auth)

2640

THE DISINTEGRATION OF RADIUM. Radha Raman Roy and Marie-Louise Goes. Compt. rend. 238, 469-71(1954) Jan. 25. (In French)

The energy distribution of the conversion electrons of Ra was measured. The coefficient of conversion of the 188-kev γ ray in the K level of Rn^{222} was determined to be 0.15, and the angular moment of the first excited state is 2. (J.S.R.)

2641

PRECISION DETERMINATION OF PHOTONEUTRON THRESHOLDS. Milton Birnbaum (Naval Research Lab., Washington, D. C.). Phys. Rev. 93, 146-54(1954) Jan. 1.

The photoneutron thresholds for C^{12}, N^{14}, O^{16}, Cu^{63}, and Ag^{109} were determined by measurement of the yield of activity as a function of the peak bremsstrahlung energy. Measurements of the photoneutron thresholds of C^{12}, N^{14}, and O^{16}, which could be calculated accurately from the mass data, served to determine the energy scale. The photoneutron thresholds for Cu^{63} and Ag^{109} were found to be 10.61 ± 0.05 Mev and 9.07 ± 0.07 Mev, respectively. The shape of the activation curves for C^{12}, N^{14}, and O^{16} appeared to be a straight line for about 350 kev near threshold. The activation curves for Cu^{63} and Ag^{109} could be fitted accurately by functions of the form $Y = k(E-E_t)^{2.23}$ and $Y = k(E-E_t)^{1.90}$, respectively, over a 3-Mev interval. E refers to the peak x-ray energy and E_t to the threshold energy. (auth)

2642

AVERAGE CHARGE OF RECOIL ATOMS FROM SEVERAL NUCLEAR TRANSITIONS. S. Wexler (Argonne National Lab., Lemont, Ill.). Phys. Rev. 93, 182-7(1954) Jan. 1.

The average charge of daughter atoms following nuclear transformation has been measured for several active species. The positive ion current of the decay products was observed in the gas of the parent at low pressure and compared with the disintegration rate of the active nuclide. The average charges found in the several transitions studied appear in the following table:

Parent activity	Type of nuclear decay	Av. positive charge (electron units)
T_2	β^-	0.9 ± 0.1
$C^{14}O_2$	β^-	1.0 ± 0.2
A^{41}	β^-	1.0 ± 0.1
Mixture of fission gases (Kr^{83m}, Kr^{85}, Kr^{87}, Kr^{88}, Xe^{135})	β^-, γ, I.T. (γ,e^-)	~1.3
$C_2H_5Br^{80m}$	Isomeric transition (γ, e^-)	10 ± 2
Kr^{83m}	Isomeric transition (γ, e^-)	7.7 ± 0.4
A^{37}	Electron capture	3.0 ± 0.2

(auth)

2643

ANGULAR DISTRIBUTIONS AND EXCITATION CURVES FOR THE $B^{10}(d,p)B^{11}$ AND THE $B^{10}(d,n)$ AND $B^{11}(d,n)$ REACTIONS BELOW 2-MEV BOMBARDING ENERGY. W. H. Burke, J. R. Risser, and G. C. Phillips (Rice Inst., Houston, Texas). Phys. Rev. 93, 188-92(1954) Jan. 1.

Protons from the $B^{10}(d,p)B^{11}$ reaction and neutrons from the $B^{10}(d,n)$ and $B^{11}(d,n)$ reactions were counted for deuteron bombarding energies below 2 Mev. Angular distributions were measured at several bombarding energies. The angular distributions suggest that the stripping process plays an important part in the reaction. As might be expected, no narrow resonances were observed in the excitation functions. (auth)

2644

EXCITATION FUNCTIONS OF PROTON-INDUCED REACTIONS OF Nb^{93}. Ralph A. James (Univ. of California, Los Angeles). Phys. Rev. 93, 288-90(1954).

The excitation functions for the (p,n), (p,pn), and (p,αn) reactions of Nb^{93} have been determined with proton energies up to 21 Mev. A new Nb activity with half life of 13 ± 2 hr was found and has been assigned to an isomeric state of Nb^{92}. This new activity decays by electron capture and emits a 2.35-Mev γ ray. Recent results by other workers on the characteristics of the 10-day Nb^{92} were verified. (auth)

2645

ANGULAR DISTRIBUTION OF PROTONS FROM THE REACTION Na^{23} (d,p) Na^{24}. Philip Shapiro (State Univ. of Iowa, Iowa City). Phys. Rev. 93, 290-4(1954) Jan. 15.

The angular distribution of several of the proton groups from the $Na^{23}(d,p)Na^{24}$ reaction was studied using 3-Mev deuterons. The results were compared with the Butler theory of the angular distributions from (d,p) reactions. A value of $l_n = 2$ is assigned to the orbital angular momentum of the neutron captured in the formation of the ground state of Na^{24} from Na^{23}. Since the available evidence indicates that the parity of the ground state of Na^{24} is even, a value of $l_n = 2$ implies that the ground state of Na^{23} also has even parity. The two proton groups resulting when Na^{24} is produced in the 0.472-Mev and 0.564-Mev excited states could not be resolved. The angular distribution of the sum of these two groups could not be uniquely interpreted. The author favors the interpretation that one of these levels is formed by capture of a neutron with $l_n = 0$ and the other by capture of a neutron with $l_n = 2$. Then both levels would have even parity, the possible spin values being 1 or 2 for one of the levels and 1, 2, 3, or 4 for the other level. The data on the 1.341-Mev level in Na^{24} indicate that it is formed by capture of a neutron with $l_n = 0$.

Hence this level has even parity and a spin of either 1 or 2. (auth)

2646

ANGULAR DISTRIBUTIONS AND YIELD OF THE REACTION $^{14}N(d,p)^{15}N$. H. M. Jongerius, F. P. G. Valckx, and P. M. Endt (Univ. of Utrecht, Netherlands). Physica 20, 29-35(1954) Jan. (In English)

Angular distributions were measured of the $^{14}N(d,p)^{15}N$ ground-state transition by nuclear emulsion techniques at deuteron energies of 0.4, 0.5, and 0.6 Mev. There is reasonable agreement with Butler's stripping theory for $l_n = 1$. The target was prepared by bombarding an aluminum foil with 200-kev nitrogen ions. The relative yield of this reaction has been measured for deuteron energies between 0.25 and 0.675 Mev using a thin-crystal NaI (Tl) scintillation spectrometer for detection of protons emitted at $\theta = 0°$ with the deuteron beam. The absolute yield at $E_d = 0.5$ Mev has also been measured by a scintillation spectrometer. In this case a target was used prepared by sandwiching a thin nylon film of known thickness between two aluminum layers. (auth)

2647

THE DECAY OF Hf^{173}. A. H. Wapstra and C. Jongejans (Inst. voor kernphysisch onderzoek, Amsterdam, Netherlands). Physica 20, 36(1954) Jan. (In English)

Hf^{173} was prepared by the α bombardment of Yb_2O_3 and purified. The active Hf was measured in a scintillation spectrometer. K radiation and two strong γ rays of 121 ± 3 and 299 ± 15 kev were found with relative intensities of 90:100:75, with errors of 15%. These results suggest that the decay of 24-hr Hf^{173} mainly proceeds to levels of 121 and 410 kev in Lu^{173}. (J.S.R.)

2648

THE DECAY OF 193 OSMIUM. H. de Waard (Rijks. Univ., Groningen, Netherlands). Physica 20, 41-3(1954) Jan. (In English)

An attempt was made to establish the disintegration scheme of the Os^{193} decay with the aid of an electron coincidence spectrometer. The conversion lines and the energies of β components in coincidence with conversion lines found in the single-count spectrum are tabulated. A tentative decay scheme for Os^{193} is given on the assumption that the ground state is $p_{3/2}$. (J.S.R.)

2649

NUCLEAR REACTIONS WITH ENERGETIC NITROGEN IONS. H. L. Reynolds, D. W. Scott, and A. Zucker (Oak Ridge National Lab., Tennessee). Proc. Natl. Acad. Sci. U. S. 39, 975-85(1953) Sept.

The results of bombarding B^{10}, B^{11}, Be^9, C^{12}, C^{13}, D, N^{14}, O^{16}, and S^{32} with 25-Mev N^{14} nuclei are reported. (K.S.)

PARTICLE ACCELERATORS

2650

Atomic Energy Research Establishment, Harwell, Berks (England)

NOTES ON THE STABILIZATION OF A 500 KILOVOLT SUPPLY FOR A PULSED PROTON BEAM. E. R. Harrison and I. A. D. Lewis. Dec. 9, 1953. 13p. (AERE-GP/M-161)

Three methods are described for stabilizing a 500-kv supply for a proton accelerator delivering pulsed beams of the order of 100 ma at a pulse length of 500 μsec and a duty cycle of 1/100. The advantages and disadvantages of each are briefly discussed, and circuits are proposed in which stabilization is effected by means of capacity potential dividers. (auth)

2651

Atomic Energy Research Establishment, Harwell, Berks (England)

MULTIPACTOR EFFECT IN LINEAR ACCELERATORS AND OTHER EVACUATED R.F. SYSTEMS, AND A NEW COLD CATHODE VALVE. L. B. Mullett, R. E. Clay, and R. J. B. Hadden. Sept. 1953. 23p. (AERE-GP/R-1076)

An account is given of the multipactor effect, and equations of motion are obtained. Phenomena observed in accelerators (with both metal and dielectric loaded waveguides) are explained on this basis. Some limiting conditions are determined for field strength and gap length in order to eliminate the multipactor effect. The multipactor effect can be used as a source of electrons which may be sufficiently bunched for use in an efficient form of high-power valve amplifier. (auth)

2652

Brookhaven National Lab.

THE COSMOTRON RADIO FREQUENCY ACCELERATING SYSTEM. PART I. FREQUENCY CONTROL SYSTEM. Edwin J. Rogers. PART 2. INTERMEDIATE AND HIGH LEVEL AMPLIFIERS. Martin Plotkin. [1953]. 27p. (BNL-1648)

The design of the Brookhaven Cosmotron r-f accelerating system is described in detail. (K.S.)

2653

European Council for Nuclear Research

A SET OF PARAMETERS FOR THE 25 GEV ALTERNATING GRADIENT SYNCHROTRON. Dec. 30, 1953. 5p. (CERN/PS/JBA-MGNH/19)

Calculations of the important parameters for the 25-Bev synchrotron to be constructed under the auspices of the European Council for Nuclear Research are presented. Maximum magnetic field at the equilibrium orbit is 12,000 gauss, the field index n = 278, r_0 = 7178 cm, and the injection energy is 50 Mev. (K.S.)

2654

European Council for Nuclear Research

THE EFFECT ON THE CLOSED ORBIT OF SAGS IN THE MAGNET PERIPHERY (DUE TO GROUND MOVEMENTS FOR EXAMPLE). Jan. 26, 1954. 3p. (CERN/PS/JBA-MGNH/20)

The effect of magnet displacements along the orbit of the 25-Bev synchrotron has been calculated. When the length of the displacement (sag) is comparable to the betatron wavelength, the closed-orbit deviations are a maximum, whereas for sags of longer length, small deviations result from deep sags. (K.S.)

2655

European Council for Nuclear Research

A STUDY OF THE VERTICAL MOTION IN THE STRONG-FOCUSING ACCELERATOR. E. R. Caianiello. Dec. 3, 1952. 19p. (CERN/T/ERC/2)

The vertical motion of the particles in the strong-focusing accelerator is studied in the customary adiabatic approximation by use of otherwise exact equations. It is shown that prescriptions may be given which guarantee that the particles will always remain, if properly injected, within a finite region around the stable orbit, whose size can be determined by means of simple inequalities. A set of tentative prescriptions of this sort is derived. (auth)

2656

Connecticut Univ.

THE CONNECTICUT HEAVY ION ACCELERATOR. Edgar Everhart, Robert J. Carbone, and Gerald Stone. Jan. 15, 1954. 21p. Contract DA-19-059-ORD-1377, Technical Report No. 1. (NO-5010)

The heavy-ion accelerator constructed at the University of Connecticut is designed to furnish a beam of helium, neon, or argon ions at any given energy between 10,000 and 250,000 electron volts. The beam current, of the order of

10 to 100 microamperes, is to be used to study details of the collisions between the beam and various gas target atoms. This report describes the accelerator itself in some detail and presents data obtained in the first tests on its operation. (auth)

2657

MICROTRONS (ELECTRON CYCLOTRONS) FOR X AND K BAND OPERATION. H. F. Kaiser (Naval Research Lab., Washington). J. Franklin Inst. 257, 89-108(1954) Feb.

Certain desirable features of the microtron favor its development as a compact, high-energy particle accelerator. When scaled for use at higher frequencies increased compactness results. This article describes two X-band microtrons which have been built and successfully operated and gives the experimental data on their operation. The principles involved in scaling the microtron for X- and K-band frequencies are discussed. (auth)

2658

ACCELERATION OF PARTIALLY STRIPPED HEAVY IONS. Robert S. Livingston (Oak Ridge National Lab., Tennessee). Nature 173, 54-7(1954) Jan. 9.

A brief description of a 63-in. heavy-particle cyclotron, its ion source, and some of the nuclear results which have been obtained is given. Some of the potentialities of this new approach for long-range research in nuclear physics and nuclear science are discussed. More than 50 μa of 25-Mev N^{+3} ions were obtained with the cyclotron. (J.A.G.)

2659

CYCLOTRON OSCILLATORS AND THE SHIFTING INTER-DEE GROUND SURFACE. F. H. Schmidt and M. J. Jakobson (Univ. of Washington, Seattle). Rev. Sci. Instr. 25, 136-9(1954) Feb.

It is shown that the push-pull mode of oscillation of a conventional two-dee cyclotron can be described in terms of a ground potential surface between the dees. Unbalance in dee voltages arising from changes in capacitance or inductance of one dee system can be interpreted as a shift of position of the ground surface. The predictions of the theory have been checked experimentally. The effects on a self-excited type of cyclotron oscillator are discussed. The principal value of the concept is that it enables the cyclotron operator to predict easily the electrical implications of a particular adjustment. (auth)

2660

CHARACTERISTICS OF A PROPOSED DOUBLE-MODE CYCLOTRON. M. J. Jakobson and F. H. Schmidt (Univ. of Washington, Seattle). Phys. Rev. 93, 303-5(1954) Jan. 15.

It is proposed to accelerate ions in a fixed-frequency cyclotron, either with the dee voltages 180° out-of-phase or with the dee voltages in-phase. This is possible if the angular extent of the dee electrodes is made less than the customary 180°. Formulas have been derived for the energy gain per turn of ions with various charge-to-mass ratios as a function of the angle of the dees. The threshold dee voltage for acceleration to a given energy is somewhat larger than that for conventional two-dee cyclotrons. For appropriate dee angles it is shown that both protons and deuterons can be accelerated in the nonrelativistic energy region at substantially the same magnetic field and oscillator frequency. Suggested applications to acceleration of ions heavier than α particles are discussed. (auth)

RADIATION ABSORPTION AND SCATTERING

2661

Consolidated Vultee Aircraft Corp.

GROUND SCATTERING OF GAMMA RAYS FROM Co^{60} SOURCE. A COMPARISON OF THEORY WITH EXPERIMENT. C. H. Bernard. Aug. 13, 1953. 32p. Contract AF33(038)21117. (CVAC-172; FZK-9-053)

A general scattering theory has been developed for ground scattering dose rates and compared with experimental measurements. A theory based on reflection coefficients (albedo) was also applied to the experimental data. The experimental results indicate that the albedo concept requires that the value of the albedo for ground scattering be dependent upon the ratio of source-detector separation to height. For small angles between ground and incident beam, the experimental data follow the single-scattering theory. (J.S.R.)

2662

National Bureau of Standards

SURVEY OF DATA ON THE INCOHERENT SCATTERING FUNCTION. Gladys White. Sept. 18, 1953. 23p. (NBS-2763)

The incoherent scattering function has been calculated for several atomic models. The calculation according to a Thomas-Fermi distribution of atomic electrons may be used as a basis for comparison since its limitations are known qualitatively on theoretical grounds. A comparison of the calculations for existing approximate models indicates that none yields accurate values of the incoherent scattering function over a large range of the recoil momentum. (auth)

2663

National Bureau of Standards

THE DISTRIBUTION OF LINEAR ENERGY TRANSFER, OR "ION DENSITY" FOR FAST NEUTRONS IN WATER. John W. Boag. Nov. 15, 1953. 49p. (NBS-2903)

The energy delivered by neutrons to a medium is dissipated along the tracks of recoil particles at different rates per unit length of track, i.e., with different 'linear energy transfer' (LET) values depending on the charge and on the instantaneous velocity of each particle. This report estimates the fraction of the total energy that is dissipated at specified rates, i.e., by particles whose LET lies within given intervals. It also estimates what fraction of the total track length of all recoil particles is traversed while the particle has an LET value within specified intervals. (auth)

2664

Palmer Physical Lab., Princeton Univ.

ELASTIC SCATTERING OF PROTONS BY NUCLEI. D. M. Chase and F. Rohrlich. Nov. 20, 1953. 19p. Contract AT-(30-1)-937. (NYO-6412)

Exact calculations are carried out for the optical model in the 20-Mev region. A complex potential of spherical well shape is assumed in addition to the Coulomb potential. Results for the elastic scattering of protons by Al, Cu, and Ag are compared with experiments. Though all relevant parameters are varied over large domains, no satisfactory agreement is obtained. Various possible alternatives are discussed. It is also shown that the "boundary condition model" offers a good approximation to the optical model within its range of validity. (auth)

2665

Palmer Physical Lab., Princeton Univ.

THE ELASTIC SCATTERING OF 18 MEV PROTONS BY Al, Fe, Ni, AND Cu. Irving E. Dayton. [Feb. 15, 1954]. 16p. Contract [AT(30-1)-937]. (NYO-6414)

The absolute differential cross section for the elastic scattering of 18-Mev protons has been measured for Al, Fe, Ni, and Cu at 35 or more angles between 15 and 172°. The statistical error of each point is 3%. The scattered protons are detected by a sodium iodide crystal whose energy resolution is about 2.5%, and the resulting pulse spectrum is recorded on a 15-channel pulse-height analyzer. For all materials used, protons scattered inelastically to the lowest known level are completely resolved from the elastic group. The differential cross

sections for the four elements are qualitatively similar, showing pronounced structure and low cross sections in the backward direction. The experimental results are in disagreement with cross sections predicted by the optical model of the nucleus. (auth)

2666

Radiation Lab., Univ. of Calif., Berkeley

THE ELECTRON COMPTON EFFECT OF 250 MEV (thesis). Frederic H. Coensgen. Nov. 1953. 61p. Contract W-7405-eng-48. (UCRL-2413)

The electron Compton effect has been investigated using photons of the bremsstrahlung beam from the Berkeley synchrotron. Photons in a 30-Mev energy band about a mean energy of 253 Mev were selected by selecting recoil electrons in a given momentum interval and measuring the angle through which the photons were scattered. It is estimated that the primary energy band is known within 3%. A Compton event was identified as a coincidence between a pulse from a photon detector and a pulse from an electron detector. The accidental coincidence rate was taken to be the coincidence rate observed when the pulses from the electron detector were delayed 8×10^{-8} sec. Cesium fluoride crystals were used to detect the photons, and phenylcyclohexane activated with 4 g/l of terphenyl was used in all other detectors. The amplitude and length of the pulses from the photomultipliers were limited in length and amplitude but not amplified before reaching the germanium diode coincidence circuit. The resolution used was 2×10^{-8} sec. Counting rates were measured to approximately 10% for photon scatter angles of 4, 8, 16, 20, and 25°. When the observed angular distribution and that predicted by the differential Klein-Nishina equation were adjusted to agree at 8°, the other experimental points were found to lie on the theoretical curve within the accuracy of the experiment. The absolute differential cross section at 8° was $d\sigma/d\Omega = 8.45 \times 10^{-27}$ photons/cm^2, which is approximately 17% larger than that predicted by the Klein-Nishina equation. This discrepancy is attributed, at present, to probable errors in the energy calibration of the synchrotron. (auth)

2667

Radiation Lab., Univ. of Calif., Berkeley

RANGE AND SPECIFIC IONIZATION FOR HIGH-ENERGY PROTONS IN NUCLEAR EMULSIONS. Otto Heinz. Jan. 12, 1954. 14p. Contract No. W-7405-eng-48. (UCRL-2458)

Stacks of nuclear emulsion varying in thickness from 18.35 g/cm^2 to 56.83 g/cm^2 were exposed in the external proton beam of the Berkeley cyclotron, and the average specific ionization dT/dx (in Mev (g/cm^2)$^{-1}$) was measured by determining the equivalent thickness of Cu needed to remove the same amount of energy from the beam as a given thickness of emulsion. The energies range from 230 to 320 Mev. The emulsion stacks consisted of layers of 200-μ Ilford C-2 stripped emulsions of average density 3.81 ± 0.01 g/cm^2. The specific ionization was found to be 1.5 percent higher for emulsion than for Cu measured over the same energy interval. From these data the ratio of the mean ionization potentials for emulsion and Cu was determined as $I_E/I_{Cu} = 0.89 \pm 0.09$. The range of 342.5-Mev protons in emulsions was found to be 92.68 ± 0.25 g/cm^2 which is 1.1 percent lower than the measured range of the same beam in Cu((93.65 ± 0.20 g/cm^2). The measured range in emulsion is about 1.5 percent shorter than the value calculated by Vigneron (and extended to higher energies by Barkas). They assumed 332 ev as the mean ionization potential of emulsion. (auth)

2668

Radiation Lab., Univ. of Calif., Berkeley

EXPERIMENTS WITH HIGH ENERGY POLARIZED PROTONS. O. Chamberlain, E. Segre, R. Tripp, C. Wiegand, and T. Ypsilantis. Jan. 1954. 5p. Contract W-7405-eng-48. (UCRL-2461)

The polarization of protons was investigated by double-scattering experiments. The beam was polarized by scattering on a target of Be or C and was deflected by a steering magnet into the shielded experimental area where a second scatterer, C or liquid H, was located. (J.A.G.)

2669

DIFFRACTION OF X-RAYS IN BENT CRYSTALS. INTEGRAL INTENSITY OF REFLECTION FOR THE TRANSMISSION METHOD. I. B. Borovskii [Borovsky] and P. A. Bezirganyan. Translated from Doklady Akad. Nauk S.S.S.R. 92, 1129-32(1953). 5p. (NSF-tr-226)

The integral of intensity of reflection was determined for a strongly divergent beam of x rays by a bent crystal. Theoretical results are compared with experimental. The integral intensity of reflection from a bent crystal several cm in size along an arc was found to be approximately 10^4 times higher than the integral intensity of reflection from a plane crystal. (C.H.)

2670

SMALL-ANGLE X-RAY SCATTERING FROM LIQUID HELIUM I AND LIQUID HELIUM II. Arthur G. Tweet (Univ. of Wisconsin, Madison). Phys. Rev. 93, 15-20 (1954) Jan. 1.

X-rays from a rotating Cu anode x-ray tube have been scattered from liquid He at angles up to 5° in the temperature range from 1.5 to 4.2°K. The He was contained in a thin-walled Al tube enclosed in a metal cryostat with Be windows. The liquid structure factor obtained experimentally, agreed well with the theoretical zero-angle liquid structure factor between 3 and 4.2°K. Below about 2°K, the observed value of the zero-angle structure factor is larger than the theoretical value by an amount believed to be outside the experimental error. Angular distributions at 4.2°K are typical of liquid scattering patterns near the critical point. No scattering anomaly was observed near the λ point. (auth)

2671

MULTIPLE SCATTERING OF RELATIVISTIC ELECTRONS. L. V. Spencer and C. H. Blanchard (Natl. Bureau of Standards, Washington, D. C.). Phys. Rev. 93, 114-16(1954) Jan. 1.

The Goudsmit-Saunderson sum for the multiple scattering of fully relativistic electrons is evaluated for the conditions of an experiment of Hanson and his collaborators. The results are consistent with those of Molière and Bethe but lie below the experimental points by as much as 15% at large angles. (auth)

2672

INELASTIC COLLISIONS AND THE MOLIÈRE THEORY OF MULTIPLE SCATTERING. U. Fano (Natl. Bureau of Standards, Washington, D. C.). Phys. Rev. 93, 117-20(1954) Jan. 1.

The effect of inelastic collisions is often introduced in the Molière theory by replacing Z^2 with $Z(Z + 1)$. It is pointed out that this procedure relies on the implied incorrect assumption that elastic and inelastic collisions have the same small-angle cut-off. Taking into account separately the cut-off of inelastic collisions, the Molière theory is shown to require the following modifications: (a) For incident electrons, replace Z^2 with $Z(Z + 1)$ and increase the Molière b by $(Z + 1)^{-\frac{1}{2}}\{\ln[0.160Z^{-\frac{2}{3}}(1 + 3.33Z\alpha^2/h\nu)] - u_{in}\}$, where $-u_{in}$ is defined as an integral over the incoherent scattering function whose value is about 5. (b) For incident heavy particles, leave Z^2 unaltered but increase b by $Z^{-1}\{\ln[1130Z^{-\frac{1}{3}}(c^2/v^2 - 1)^{-1}] - u_{in} - \frac{1}{2}v^2/c^2\}$. (auth)

2673

NEUTRON INELASTIC SCATTERING. Robert M. Kiehn and Clark Goodman (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 93, 177-8(1954) Jan. 1.

The neutron inelastic scattering of iron has been studied as a function of neutron energy from the threshold at 850 kev to 2.0 Mev. The yield of 850-kev gamma rays emitted by deexcitation of the first excited state has been measured by means of a NaI scintillation spectrometer. Similar work is in progress on Al, Pb, Bi, and other elements. (auth)

2674

INELASTIC SCATTERING OF NEUTRONS BY In^{115} AND Au^{197}. A. A. Ebel and Clark Goodman (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 93, 197-8(1954) Jan. 1.

The metastable states In^{115m} and Au^{197m} have been produced by bombarding indium and gold foils with neutrons (energy spread ±20 to 40 kev). The excitation curve for gold has a threshold at 0.53 ± 0.02 Mev and shows distinct discontinuities in slope at 1.14 ± 0.03 Mev and 1.44 ± 0.03 Mev corresponding to energy levels that decay to the metastable state at 0.54 Mev. The excitation curve for indium has a threshold below 600 Mev and indicates levels at 0.960 ± 0.04 Mev and 1.36 ± 0.04 Mev. Cross-section values cannot be deduced because of inadequate calibration of the scintillation detector. (auth)

2675

THREE-BODY SCATTERING PROBLEMS. Sidney Borowitz and Bernard Friedman (New York Univ.). Phys. Rev. 93, 251-2(1954) Jan. 1.

This note is presented to clarify certain questions which arose concerning the portion of a recent paper of the authors (Phys. Rev. 89, 441(1953)) which dealt with exchange scattering. In particular, a discussion is presented of the problem of exchange scattering as treated by the authors and by Mott and Massey (THEORY OF ATOMIC COLLISIONS, 2nd ed. Oxford, Clarendon Press, 1949. Chap. VIII). (L.M.T.)

2676

RESONANT SCATTERING OF RECOIL-BROADENED GAMMA RAYS. K. Ilakovac and P. B. Moon (Univ. of Birmingham, England). Phys. Rev. 93, 254(1954) Jan. 1.

In order for β recoil to be free and persist for a long time compared to γ-ray lifetime, gaseous sources are usually preferred. Since this is sometimes impracticable, it was felt that advantage might be gained by using liquid rather than solid sources. This was demonstrated in an experiment in which a Cu cyclotron target containing Cu^{63} showed no measurable selective scattering of the 0.98-Mev γ ray by Cu, but clearly showed the effect when a HNO_3 solution of the target material was used as the source. (L.M.T.)

2677

TEMPERATURE VARIATION OF THE MAGNETIC INELASTIC SCATTERING OF SLOW NEUTRONS. Léon Van Hove (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 92, 268-9(1954) Jan. 15.

The main features of the temperature variation of the magnetic inelestic scattering of slow neutrons in Fe, recently measured by Palevsky and Hughes, are accounted for by use of a theoretical description of the scattering in terms of the correlation between pairs of spins at different positions and different times. Proofs will be given in a later paper devoted to a general discussion of space-time correlations and of their use in scattering theory. (auth)

2678

ANGULAR DISTRIBUTIONS OF 22-MEV PROTONS ELASTICALLY SCATTERED BY VARIOUS ELEMENTS. Bernard L. Cohen and Rodger V. Neidigh (Oak Ridge National Lab., Tenn.). Phys. Rev. 93, 282-7(1954) Jan. 15.

Angular distributions of 22-Mev protons elastically scattered by 15 elements from Be to Th were measured with the internal, circulating beam of the Oak Ridge National Lab. 86-in. cyclotron. The experimental methods, which are somewhat unconventional, are described. The results show all the characteristics of diffraction scattering including at two maxima and minima for each element. The angles at which these occur can be traced from element to element through the periodic table, following a λ/R dependence with fairly good accuracy. (auth)

2679

THE ELASTIC SCATTERING OF PROTONS BY ALPHA PARTICLES. S. Sack, L. C. Biedenharn, and G. Breit (Yale Univ., New Haven, Conn.). Phys. Rev. 93, 321-5(1954) Jan. 15.

The $p_{1/2}$ and $p_{3/2}$ phase shifts determined from analysis of the elastic scattering of protons by α particles are treated in terms of a potential interaction between the proton and α particle core, with a spin-orbit interaction of the Thomas type. The results are sensitive to the well shape chosen and favor a Gauss well interaction. The limitations of this type of treatment are discussed. (auth)

2680

ONE OF SCHWINGER'S VARIATIONAL PRINCIPLES FOR SCATTERING. Geoffrey F. Chew, (Univ. of Illinois, Urbana). Phys. Rev. 93, 341-3(1954) Jan. 15.

An approximation method for scattering calculations, based on a variational principle invented by Schwinger, is discussed. The method is tractable even for interactions, such as the pion-nucleon, which are not diagonal in configuration space. Criteria of validity for the approximation are proposed and made plausible by examples. (auth)

2681

THE EFFECT OF INELASTIC COLLISIONS ON THE SLOWING-DOWN LENGTH OF NEUTRONS IN A HYDROGENOUS MIXTURE. Howard C. Volkin (National Advisory Committee for Aeronautics, Cleveland, Ohio). J. Appl. Phys. 25, 83-6(1954) Jan.

An expression for the slowing-down length of neutrons in a hydrogenous mixture in which inelastic collisions occur is derived from the rigorous transport equation under the assumptions that (1) the masses of the nonhydrogen nuclei are infinite and (2) the inelastic scattering is of the type in which only discrete well-defined energy levels of the target nucleus are involved. The result is applied to an Fe–H_2O mixture. (auth)

2682

SELF-ABSORPTION OF THE DISINTEGRATION ELECTRONS FROM In^{116} IN INDIUM METAL. M. A. Vigon and E. Montero (Junta de Energia Nuclear, Madrid, Spain). Naturwissenschaften 40, 458(1953) Sept. (In German)

The apparatus for measuring the self-absorption of the disintegration electron from In^{116} is sketched. The total intensity of the β and γ radiation was measured as a function of the absorbent thickness. The value of the function can be approximated by a summation of the electron absorption and γ absorption in the form $F(X) = g_\beta \exp(-\alpha_\beta X) + g_\gamma \exp(-\alpha_\gamma X)$. The experimental values of $g_\beta = 0.94 \pm 0.04$ and $g_\gamma = 0.06 \pm 0.02$ are in good agreement with the theoretical values. The absorption coefficient of In is 29.4 ± 1.5 cm^2/g. (J.S.R.)

2683

ANALYSIS OF THE ČERENKOV RADIATION EMITTED BY A RAPID CHARGED PARTICLE PENETRATING AN EMULSION; APPLICATION TO THE ENERGY LOSS. P. Janssens (Univ. Libre de Bruxelles, Belgium). Science et inds. phot. 23A, 354-6(1953). (In French)

The theoretical analyses of the Cherenkov radiation emitted by a charged particle penetrating an emulsion and the resultant energy loss are reevaluated. (J.S.R.)

2684
MULTIPLE SCATTERING OF FAST ELECTRONS. O. Knecht and W. Bothe (Max-Planck-Institut für med. Forschung, Heidelberg, Germany). Z. Naturforsch. a8, 805-14(1953) Dec. (In German)

From the β spectrum of RaE a homogeneous parallel bundle in the energy range 250 to 1000 kev was separated, and from it the multiple scattering in metal foil (Al, Ni, Ag, and Au) was measured for different thickness. The measurements of the form and width of the angular distribution behind the foil were compared with the different theories of multiple scattering. There was complete agreement with the Molière theory in its binding force region. For a practical determination of the angular distribution, as well as the validity limits of the theory, a simple procedure was set up. Other measurements were made on the angular distribution behind slanting foils. The measurements confirmed the calculations of the validity range. (tr-auth)

2685
ELECTRON CAPTURE BY SLOW SINGLY CHARGED HELIUM IONS IN HELIUM. J. David Jackson (McGill Univ., Montreal, Quebec, Canada). Can. J. Phys. 32, 60-4(1954) Jan.

The capture of electrons by slow singly charged He ions passing through He gas is discussed theoretically. Calculations of the capture cross section for incident ion energies from 200 ev to 100 kev are made using an impact-parameter method due to Kohn. In this energy interval the computed cross section is found to be fitted very closely by the empirical expression $(\sigma/\pi\alpha_0^2) = 7.94 - 2.35 \log_{10}E(\text{kev})$. The results are compared with recent experimental data. The agreement between theory and experiment is good, except for the data of Keene. (auth)

RADIATION EFFECTS

2686
Knolls Atomic Power Lab.
X-RAY SCATTERING BY LATTICE DEFECTS IN NEUTRON IRRADIATED SINGLE CRYSTALS OF BORON CARBIDE. Charles W. Tucker, Jr. and Peter Senio. [1954] Decl. Jan. 27, 1954. 7p. Contract W-31-109-Eng-52. (AECD-3613)

2687
THE ACTION OF CERTAIN PROTECTIVE COMPOUNDS ON γ-RAY DAMAGE TO POLYMERIC SOLUTIONS. Manfred Fox. Compt. rend. 237, 1682-4(1953) Dec. 21. (In French)

The effect of various organic compounds on the extent of γ-ray damage to styrene polymers in $CHCl_3$ was studied by viscosity measurements after irradiation by Co^{60}. Several conclusions are drawn concerning the nature of the mechanism involved in producing the observed results. (K.S.)

2688
A NEW METHOD FOR STUDYING CERTAIN PHYSICO-CHEMICAL EFFECTS OF IRRADIATION IN PILES. MEASUREMENT OF ELECTROMAGNETIC ABSORPTION OF SOLIDS. Francis Duhamel, Marie Freymann and René Freymann. Compt. rend. 237, 1684-5(1953) Dec. 21. (In French)

It is shown, for the particular case of a given sample of ZnO, that the measurement of electromagnetic absorption (0.2 to 1000 kc) provides a method for investigating the lattice defects in irradiated solids. The positions and intensities of various spectra bands are determined. This technique lends itself to the examination of powders (opaque to visible spectra) without preliminary treatment. (tr-auth)

2689
EXPANSION OF COPPER BOMBARDED BY 21-MEV DEUTERONS. William R. McDonell and Henry A. Kierstead (Argonne National Lab., Lemont, Ill.). Phys. Rev. 93, 247 (1954) Jan. 1.

Copper tubes 16 in. long, 0.052 cm thick, and of outside diameter $^3/_{32}$ to $^3/_{16}$ in. were bombarded with 21-Mev deuterons in the Argonne cyclotron and specific volume increases determined. The samples were first bombarded at −196°C, annealed during warm-up to room temperature, and then bombarded at 25°C. The data apparently constitute evidence for a bombardment-induced volume expansion in Cu, presumably due to the production of vacancy and interstitial atoms. (L.M.T.)

RADIOACTIVITY

2690
Knolls Atomic Power Lab.
THE MAJORANA NEUTRINO AND BETA-DECAY. Henry Brysk, Vanderbilt Univ. and Paul F. Zweifel, Knolls Atomic Power Lab. [1953]. 2p. Contract W-31-109-Eng-52. (AECU-2800)

2691
Los Alamos Scientific Lab.
THE DISINTEGRATION OF Y^{91}. M. E. Bunker, J. P. Mize, and J. W. Starner. [1953] 15p. [Contract W-7405-eng-36]. (AECU-2822)

The radiations of the fission product Y^{91} have been investigated with β- and γ-scintillation spectrometers. In addition to the well known 1.55-Mev groundstate β transition, there is a weak (0.3%) β transition of energy 0.330 Mev which is followed by a γ ray of energy 1.22 ± 0.01 Mev. Definite assignment of these radiations to Y^{91} was established through exacting chemical procedures, measurement of the half life of the γ ray, and energy balance considerations. There is reason to believe that the 1.22-Mev level of $_{40}Zr^{91}_{51}$ is not a simple single-particle state. (auth)

2692
Oak Ridge National Lab.
COULOMB EXCITATION AND ANGULAR CORRELATION. R. K. Osborn and M. E. Rose. Mar. 16, 1954. 17p. Contract W-7405-eng-26. (ORNL-1685)

The direction of emission of the γ rays emitted by nuclei which have been excited by Coulomb interaction with charged particles is correlated with the direction of incidence of these particles and the angle through which they are scattered. In practice it is convenient to carry out the envisaged experiment so that the scattered particle is not observed. This is assumed to be the case in the following. The results of a calculation for the correlation between the incident beam direction and a subsequent single γ ray for the case of quadrupole excitation have been published by Alder and Winther (Phys. Rev. 91, 1578(1953)). It is the purpose of this report to present the details of this calculation and to generalize the results to cover the case of the triple correlation between the incident beam direction and two subsequent γ rays, either or both of which may be mixed. (auth)

2693
Radiation Lab., Univ. of Calif., Berkeley
SPECTROMETER STUDIES OF THE RADIATIONS OF NEUTRON DEFICIENT ISOTOPES OF CESIUM AND OF THE E3 ISOMERS, Xe^{127m} AND Xe^{125m}. Hirdaya B. Mathur and Earl K. Hyde. Jan. 25, 1954. 40p. (UCRL-2469)

Cs isotopes produced by $I^{127}(\alpha,xn)$ reactions in the 60-in. and 184-in. cyclotrons were studied in Geiger counters, a mass spectrometer, β-ray spectrometers, a NaI crystal scintillation spectrometer and a γ-γ coincidence spectrometer. The mass assignment of 30-min Cs^{130} was verified. The 6.25 hr Cs^{127} was shown to decay predominantly by electron capture but also by the emission of positrons of 1.063-

and 0.685-Mev energy. Prominent γ rays of 61, 125, and 406 kev are observed. Cs^{127} exhibits branching decay of 75-sec Xe^{127m} in about one disintegration in 10^4. This isomer was isolated and studied in a scintillation spectrometer. E3 radiation of 175 kev connecting $h_{11/2}$ and $d_{3/2}$ levels is followed by 125-kev M1 radiation corresponding to a $d_{3/2}$-$d_{3/2}$ transition to the ground state. Forty-five-minute Cs^{125} is shown to decay predominantly by electron capture and also by the emission of positrons of 2.05-Mev energy. Other lower energy positron groups are present. Prominent γ rays of 66 and 112 kev are observed. In one disintegration in about 10^3, Cs^{125} decays to a 55-sec Xe^{125m}. This isomer emits γ rays of 75 and 110 kev which are believed to be E3 $h_{11/2}$-$d_{5/2}$ and M1 $d_{3/2}$-$d_{3/2}$ transitions, respectively. An incomplete study of Cs^{123} shows it to be a 6-min positron emitter. (auth)

2694

THE DECAY OF Cd^{105}. F. A. Johnson (McGill Univ., Montreal, Canada). Can. J. Phys. 31, 1136-47(1953) Nov.

The isotope Cd^{105} (55 min) has been produced by the Ag^{107} (p,3n) reaction in the McGill University synchrocyclotron and has been investigated by means of a 180° spectrograph of high resolution, a lens spectrometer, and a scintillation spectrometer. The positron end point was found to be 1.691 ± 0.005 Mev and the Fermi plot of the spectrum was straight down to about 800 kev where a slight upward curvature began. Internal conversion lines found in the 180° spectrograph indicated γ rays of energies 25.50, 27.69, 263.0, 292.5, 308.0, 312.1, 317.1, 320.5, 324.9, 336.3, 340.7, 347.0, 433.1, and 606.7 kev. High-energy internal conversion lines found in the lens spectrometer beyond the end point of the positron spectrum were assigned to γ rays of energies 1.908, 1.957, 1.995, 2.045, 2.277, and 2.318 Mev. In addition, lines assigned to Ag^{105} have been recorded. These correspond to γ rays of energies 64.0, 280.8, 319.4, 331.5, 344.9, 392.6, and 443.2 kev, of which that of 331.5 kev has not been reported previously. (auth)

2695

COINCIDENCE STUDIES OF THE DECAY OF INDIUM 114. M. W. Johns, C. C. McMullen, R. J. Donnelly, and S. V. Nablo (McMaster Univ., Hamilton, Ontario, Canada). Can. J. Phys. 32, 35-48(1954) Jan.

A coincidence circuit of resolving time 3×10^{-9} sec has been used to examine the decay of In^{114}. Coincidence experiments are described to show that of the 5 γ rays which follow the K-capture process, the 0.722- and 1.300-Mev radiations are both in cascade with the 0.556-Mev γ ray and that the spins and parities of the excited levels of energy 0.556, 1.278, and 1.856 Mev in Cd^{114} are 2+, 2+, and 0+, respectively. The observed β-γ coincidences may be ascribed to a combination of inner bremsstrahlung associated with the strong 2-Mev β^- transition and a weak β^- group of intensity less than 1×10^{-3} β per disintegration and end point about 0.8 Mev. The positron spectrum has a branching ratio of $(4 \pm 1) \times 10^{-5}$ and an end point between 1.0 and 1.4 Mev. (auth)

2696

STUDY OF THE FINE STRUCTURE OF α RADIATION FROM U^{234}. Georges Valladas. Compt. rend. 237, 1673-5(1953) Dec. 21. (In French)

The fine structure of U^{234} α emission is studied by using a pulse ionization chamber. The energy of the α_1 ray is determined. It is shown that a second ray exists near 170 kev from α_0. (tr-auth)

2697

CORRECTION FORMULA FOR THE COUNTING OF TRAJECTORIES IN NUCLEAR EMULSIONS. A. Herpin and C. Mercier (Centre d'Études Nucléaires, Saclay, France). J. phys. radium 15, 21-6(1954) Jan. (In French)

Formulas are given for the calculation in all possible cases of the actual reaction density by a count of the trajectories in a nuclear emulsion. (tr-auth)

2698

STUDY OF THE RATIO ELECTRON CAPTURE/β^+ OF Sc^{44}. H. Langevin and N. Marty (Lab. de Chimie Nucléaire, France). J. phys. radium 15, 127-8(1954) Feb. (In French)

The decay scheme of Sc^{44} generally accepted is in disagreement with the theoretical value of $1/25$ for the ratio electron capture/β^+ = Pe/P_+. The Pe/P_+ ratio was measured by comparison of the Sc^{44} spectrum with that of Na^{22}. A value of Pe/P_+ = 0.1 was obtained. (J.S.R.)

2699

THE RADIOACTIVITY OF THE ATMOSPHERE. O. Haxel and G. Schumann (Univ. of Heidelberg, Germany). Naturwissenschaften 40, 458-9(1953) Sept. (In German)

From March 19, 1953 until the middle of June the atmospheric radioactivity was measured at Heidelberg (565m above sea level). Diagrams show the amount of radioactivity. (J.S.R.)

2700

RADIOACTIVITY OF NEUTRON EXCESS IRIDIUM ISOTOPES. F. D. S. Butement and A. J. Poë (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (7) 45, 31-7(1954) Jan.

The half lives, mass assignments, and radiation characteristics of the neutron excess Ir isotopes have been determined. The γ-ray energies of 19-hr Ir^{194} have also been examined. The 7-sec Ir^{194m} isomer is either a 125-kev E3 transition followed by the 5.6-Mev γ ray or possibly a 5.6-Mev M6, E6, or E7 transition followed by a 125-kev M1, E2, or E3 γ ray. The latter alternative would be the highest spin-change γ-decaying isomer yet discovered, and both are unusual in the very high-energy transition involved. (auth)

2701

GAMMA RADIATION FROM THE DECAY OF $^{228}_{90}Th$. J. O. Newton and B. Rose (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (7) 45, 58-62 (1954) Jan.

The energies and relative intensities of the γ rays following the α-particle decay of Th^{228} have been investigated with proportional counters. Lines were observed at 84.4 ± 0.2, 132.3 ± 1.3, 167 ± 2 and 214 ± 3 kev. The multipolarity of some of the γ-ray transitions is discussed, and two possible decay schemes are presented. (auth)

2702

RADIOACTIVITY OF Sm^{153} AND Eu^{155}. M. R. Lee and R. Katz (Kansas State Coll., Manhattan). Phys. Rev. 93, 155-9 (1954) Jan. 1.

The radiations from Sm^{153} and Eu^{155} have been studied by means of a 180-degree, magnetic-focusing, variable-field beta-ray spectrometer-spectrograph using enriched materials. In the disintegration of 47.0-hr Sm^{153}, conversion electrons of three gamma rays of energy, 0.0691, 0.1027, 0.548 Mev, and three beta-ray spectra whose end-point energy and relative intensity were 0.255 Mev, 9 percent; 0.685 Mev, 70 percent; 0.795 Mev, 21 percent, respectively, were observed. A fourth beta-ray spectrum of end-point energy 0.62 Mev and intensity less than 6 percent is postulated. A decay scheme in good agreement with these data and with nuclear shell theory is proposed in which spin and parity have been assigned to all levels. The discrepancy between the magnetic moment measurement and the requirements of shell theory as to the parity of the ground state of Eu^{153} has been resolved in favor of shell theory. In the disintegration of Eu^{155} two beta-ray spectra of end-point energy 0.152 and 0.252 Mev and relative intensity 84 percent and 16 percent, respectively, and conversion of four gamma rays of energy 0.0593, 0.0858, 0.1045, 0.1309 Mev were observed, in agreement with earlier

work. Weak conversion-electron lines attributed to gamma rays of energy 0.0187 and 0.1368 Mev were also observed. (auth)

2703
DECAY OF Cu^{60} AND NUCLEAR LEVELS IN Ni^{60}. R. Van Lieshout, R. H. Nussbaum, G. J. Nijgh, and A. H. Wapstra (Inst. for Nuclear Research, Amsterdam, Holland). Phys. Rev. 93, 255-6(1954) Jan. 1.

The γ and β spectra of Cu^{60} were examined with single-channel scintillation and magnetic-lens type spectrometers, respectively. A more complex decay scheme than one previously given (Leith et al., Phys. Rev. 73, 732(1947)) is presented. The half life of Cu^{60} was determined as 23.4 min. (L.M.T.)

2704
β DECAY AND BINDING ENERGY OF THE ELECTRON SHIELD. THE PRIMARY β SPECTRUM OF RaD. E. Huster (Univ. of Marburg/Lahn, Germany). Sitzber. Ges. Beforder. ges. Naturw. Marburg 75, 13-17(1953). (In German)

A theoretical consideration of the form which the freed energy of the electron shell assumes after β decay is presented. A measurement of the β spectrum of Pb^{210} supports the theory that the freed energy is emitted together with the energy difference of the nucleus and is distributed between the electron and a neutrino. (J.S.R.)

RARE EARTHS AND RARE-EARTH COMPOUNDS

2705
PEROWSKITE-TYPE OXIDES OF COBALT, CHROMIUM AND VANADIUM WITH SOME RARE EARTH ELEMENTS. Aaron Wold and Roland Ward (Univ. of Conn., Storrs). J. Am. Chem. 76, 1029-30(1954) Feb. 20.

The crystal structure of oxides of Co, Cr, and V with La, Ce, Pr, Nd, and Sm were obtained. The compounds corresponded to the formula ABO_3, where A is a rare earth and B is a transition metal. (J.S.R.)

2706
ISOTOPE SHIFT IN THE $_{58}$Ce II SPECTRUM. Hack Arroe (Univ. of Wisconsin, Madison). Phys. Rev. 93, 94(1954) Jan. 1.

The spectrum of Ce II from enriched samples of Ce^{136} and Ce^{138} has been studied and compared with the same spectrum from natural Ce. Only a negligible isotope shift, certainly less than 6% of that between the isotopes with 82 and 84 neutrons, has been found between the isotopes with 78, 80, and 82 neutrons. (auth)

SHIELDING

2707
Stanford Research Inst.
PRINCIPLES GOVERNING THE CONSTRUCTION OF SHIELDED ROOMS. INTERIM REPORT. Edward M. T. Jones. Apr. 12, 1951. 32p. Contract NOy-22272. (NP-5060)

2708
Utah Univ.
SHIELDING EFFICIENCY OF REMOTE HANDLING CELL AND MONITORING ROOM. (DUGWAY PROJECT). G. Abel, K. Anderson, and E. Campagna. Jan. 27, 1954. 61p. Contract DA-18-108-CML-4753. (UUT-2)

Results are presented of measurements of the attenuation of γ rays by remote handling cell windows and monitoring room windows filled with water and with $ZnBr_2$ solution. Measurements were made to determine the quantity of scattered radiation issuing from the remote handling cell door slits, the magnitude of shielding provided by the concrete walls and ceiling of the rooms, and possible hazards from access holes and faulty concrete construction of the walls. Data are presented in tabular form. (C.H.)

SPECTROSCOPY

2709
Bausch and Lomb Optical Co.
INFRARED TRANSMISSION FILTERS. [QUARTERLY TECHNICAL REPORT NO. 3]. OCTOBER 23, 1952 TO JANUARY 22, 1953. A. Francis Turner. Jan. 19, 1953. 224p. Contract DA-44-009-eng-1113. (AD-5092)

2710
Radiation Lab., Univ. of Calif., Berkeley
THE ABSORPTION SPECTRUM OF PuF_3 (thesis). Ralph D. McLaughlin. Dec. 1953. Decl. Jan. 21, 1954. 18p. Contract W-7405-Eng-48. (UCRL-2440)

The absorption spectrum of PuF_3 was measured over the region 2,500 to 9,000 A. Six constant differences were found of less than 1,000 cm^{-1}. It was not possible to determine if any of these were due to low-lying levels. (auth)

2711
OPTICAL METHOD OF DETERMINING THE CONCENTRATION OF ATOMS AND MOLECULES IN THE GROUND STATE. A. M. Shukhtin. Translated from Doklady Akad. Nauk S.S.S.R. 92, 553-5(1953). 3p. (NSF-tr-201)

2712
POLARIZATION OF THE LUMINESCENCE OF F-CENTERS IN CRYSTALS OF ALKALI HALIDES. P. P. Feofilov. Translated from Doklady Akad. Nauk S.S.S.R. 92, 743-6 (1953). 4p. (NSF-tr-208)

A study of the anisotropies of the luminescence of F-centers in large single crystals of LiF and NaF is presented. The results are compared with a similar study of CaF_2. Spontaneous polarization was observed in the plates cut parallel to the plane, as well as the azimuthal dependence of the intensity of luminescence with linearly polarized excitation, in all 3 specimens. However, in the case of LiF and NaF, the absolute values of the spontaneous polarization are considerably smaller than in CaF_2, while the azimuthal dependence of the intensity of luminescence is much less pronounced, which corresponds approximately to the case of the isotropic distribution of oscillators. (J.A.G.)

2713
SPECTROPHOTOMETRIC METHODS FOR DETERMINING THE INTENSITY, FORM, AND WIDTH OF INFRARED ABSORPTION BANDS OF LIQUIDS. A. V. Iogansen. Translated from Doklady Akad. Nauk S.S.S.R. 92, 919-22 (1953). 4p. (NSF-tr-215)

If the resolving power of a spectral apparatus is comparable with the width of the absorption bands under study, then the observed intensities, width, and form of the bands differ from the true ones. The true absorption of the maximum of the band can be obtained by extrapolation to an infinitely narrow slit. From the observed absorption, the absorption coefficient and the band width can be derived. (J.S.R.)

2714
A GLASS SPECTROGRAPH WITH A PLANE GRATING AND OF HIGH LIGHT-GATHERING POWER. SOME OF ITS APPLICATIONS IN RAMAN SPECTROSCOPY. Ya. S. Bobovich and M. M. Pakhomova. Translated from Doklady Akad. Nauk S.S.S.R. 92, 947-50(1953). 4p. (NSF-tr-222)

A glass spectrograph with a plane grating was constructed. A dispersion of 42 A/mm was obtained. The apparatus was used to study the Raman spectra of substances which can be excited with the Hg 5461A line. Part of the Raman spectra of iodobenzene, p-nitrophenetole, and naphthalene are given to show the diversity of application of a grating spectrometer. (J.S.R.)

2715
GAMMA-RAY SPECTROSCOPY. S. C. Curran (Univ. of Glasgow, Scotland). Advances in Phys. 2, 411-49(1953) Oct.

A general survey of γ-ray theory, spectroscopy, and measuring techniques is given. (K.S.)

THEORETICAL PHYSICS

2716

Solid-State and Molecular Theory Group, Mass. Inst. of Tech.

QUARTERLY PROGRESS REPORT NO. 10. Oct. 15, 1953. 53p. Contract N5ori-07856. (NP-4918)

The wave functions of impurity levels can be approximated by making a superposition of Wannier functions on different atoms and in different energy levels in the Schroedinger equation. A scheme is outlined for the solution of the periodic potential problem by taking a single plane wave in the region between the spheres and matching this to a solution of the spherical Schroedinger problem within each sphere. The scattering problem in such a solution is solved by superposing a number of such plane waves, which may be called augmented plane waves. The energy relations in the augmented plane wave method are discussed. Completely nonempirical calculations may be made on simple molecules using a revised form of the valence bond theory, starting from a set of localized but orthogonal orbitals constructed from the basic atomic orbits. Calculations on antiferromagnetism, in which the He^+ model was used, were made in terms of nonorthogonalized orbitals. The final wave functions were expanded in terms of orthogonalized orbitals. Calculations were made of the interaction of 2 p electrons to see whether they can have a ferromagnetic interaction, as in O_2. The results of a configuration interaction between the configurations in which both the electrons are in the symmetric state or both in the antisymmetric state are given. (For preceding period see NP-4702.) (J.S.R.)

2717

Naval Research Lab., Univ. of Wis.

AN APPROXIMATE THEORY OF INELASTIC COLLISIONS. James F. Hornig and J. O. Hirschfelder. Oct. 9, 1953. 33p. Contract N7onr-28511. (WIS-ONR-5)

Approximate trajectories for describing the inelastic encounters between rigid diatomic molecules are described. These trajectories, together with quantum-mechanical perturbation theory, are used to derive an approximate formulation of the inelastic differential scattering cross sections for such collisions. The quantum-mechanical correspondence principle is used when necessary to bridge the gap between classical and quantum descriptions of the problem. (auth)

2718

INTERACTION OF GRAVITATION WITH A PARTICLE VACUUM. D. Ivanenko and A. Brodskii [Brodsky]. Translated from Doklady Akad. Nauk S.S.S.R. 92, 731-4(1953). 5p. (NSF-tr-218)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-1767.

2719

QUANTUM DISTRIBUTIONS IN DIFFERENTIAL SPACE FOR SPIN-DEPENDENT WAVE FUNCTIONS. Norbert Wiener and Armand Siegel. Compt. rend. 237, 1640-2 (1953) Dec. 21. (In French)

A previous note (Phys. Rev. 91, 1551(1953)), which presented a new method of quantum distributions in differential space only, outlined the application of this method to spin-dependent wave functions. The present work extends the theory of this subject. (tr-auth)

2720

INTRODUCTION TO AN ELECTRON-NEUTRINO THEORY OF THE PHOTON. Bernard Jouvet. Compt. rend. 237, 1642-4(1953) Dec. 21. (In French)

It is shown by an example that the photon is an interpretation, in elementary corpuscular terms, of the interaction between electrons by means of the electron and neutrino fields. (tr-auth)

2721

ON THE VARIATIONAL PRINCIPLES OF QUANTUM MECHANICS. Guy Rideau. Compt. rend. 237, 1646-8 (1953) Dec. 21. (In French)

A method is given for determining variational principles of collision theory which result in an indefinite number of such principles. The same method, on the other hand, permits the existence of a unique, independent rule for standard trial functions. (tr-auth)

2722

ON THE DETERMINATION OF SOLUTIONS OF THE WAVE EQUATION FOR PARTICLES OF SPIN $\hbar/2$ INTERACTING WITH A PSEUDOSCALAR RADIAL POTENTIAL. Gérard Petiau. Compt. rend. 237, 1648-50(1953) Dec. 21. (In French)

A new solution of the wave equation for the particle of spin $\hbar/2$ is given for interactions with a pseudoscalar radial potential. A complete solution is given for the case of a potential $U(r) = Cr$. (tr-auth)

2723

THEORETICAL CONSEQUENCES OF THE ELECTRO-NEUTRINO THEORY OF THE PHOTON. Bernard Jouvet. Compt. rend. 238, 327-9(1954) Jan. 18. (In French)

Generalization of the Maxwell standard invariance introduces the possibility of the existence of current distributions which, although charged in the usual sense of the word, do not have effective electric interactions. The identity of the constant for charge e is shown for all particles. (tr-auth)

2724

NON PERTURBATION TREATMENT OF SCATTERING IN QUANTUM FIELD THEORY. M. Cini and S. Fubini (Univ. of Turin, Italy). Nuovo cimento (9) 11, 142-52 (1954) Feb. (In English)

A sequence of approximations to the S and K operators is obtained by means of a variational method. The form of the approximations is such that discussions on general questions like convergence and renormalization become possible without any weak coupling assumption. The method is particularly suited for the study of two-body collision problems: in this case the difficulties in the treatment of the higher-order approximations are reduced to the problem of evaluating the perturbation S-matrix elements. (auth)

2725

ON CORBEN'S FORMULATION OF THE DIRAC EQUATION. O. Bergmann and N. Baker (Univ. of Adelaide, Australia). Nuovo cimento (9) 11, 203-4(1954) Feb. (In English)

The equivalence of Corben's formulation of the Dirac theory is questioned. If the interaction terms are inserted in their conventional form into the fundamental equation of Corben's formalism, it is seen that the equivalence does not hold for charged particles. (J.S.R.)

2726

A STOKES-PARAMETER TECHNIQUE FOR THE TREATMENT OF POLARIZATION IN QUANTUM MECHANICS. U. Fano (Natl. Bureau of Standards, Washington, D. C.). Phys. Rev. 93, 121-3(1954) Jan. 1.

A technique is presented which adapts the stokes method to quantum mechanics and serves to calculate polarization effects by means of Pauli matrices. Illustrative examples indicate that this technique may be not only convenient mathematically but also physically more transparent than previous methods. (auth)

2727
AN IDENTITY FOR THE S MATRIX A FINITE TIME INTERVAL. J. C. Polkinghorne (Trinity Coll., Cambridge, England). Phys. Rev. 93, 228-9(1954) Jan. 1.

An identity is obtained for the S matrix for a finite time interval that expresses the "scale-free" character of quantum field theory. (auth)

2728
QUANTIZATION OF A NONLINEAR FIELD THEORY. Herbert B. Rosenstock, (Univ. of North Carolina, Chapel Hill). Phys. Rev. 93, 331-3(1954) Jan. 15.

A quantization procedure, involving the expansion of the field in a space lattice of classical particles, is suggested for a field theory in which classical particles appear as small regions in which the field is intense. Approximate energy eigenvalues are calculated for certain values of the parameters involved. (auth)

2729
BOUND PARTICLES AND SCATTERING PROBLEMS IN THE QUANTUM FIELD THEORY. Ernst Freese (Max-Planck Institut für Physik, Göttingen, Germany). Z. Naturforsch. a8, 776-90(1953) Dec. (In German)

Physical processes can be described, within the limits of a selected quantum field theory, by means of "wave functions." The experimentally observed magnitudes can be calculated from their differential and integral equations. Correlations with the Dyson s-matrix were derived. (tr-auth)

TRITIUM AND TRITIUM COMPOUNDS

2730
Chalk River Project (Canada)
SOME PRELIMINARY RESULTS ON THE ABSOLUTE BETA COUNTING OF TRITIUM. R. C. Hawkings and W. F. Merritt. Jan. 1954. 5p. (CRP-560; AECL-94)

Preliminary results on the absolute gas counting of T were reported and compared with the results on different aliquots of the same sample obtained by a calibrated ion chamber and a microcalorimeter. The procedures for gas counting and microcalorimetric determination are outlined. The activity was 3.92 ± 0.05 c/ml by gas counting, 3.99 ± 0.04 c/ml by ion chamber, and 4.15 ± 0.08 by microcalorimetry. (J.S.R.)

2731
THE NATURAL TRITIUM CONTENT OF ATMOSPHERIC HYDROGEN. A. V. Grosse and A. D. Kirshenbaum (Temple Univ., Philadelphia, Penna.) and J. Laurence Kulp and W. S. Broecker (Columbia Univ., Palisades, N. Y.). Phys. Rev. 93, 250-1(1954) Jan. 1.

Techniques are described and results are presented for an experiment in which molecular H of ground-level air was assayed for natural T content. Twenty-five cc of H_2O were produced from atmospheric H taken 5 ft off the ground in the Ne-He fraction of air at the Buffalo, N. Y. (lat. = 42.9°N) liquid air plant of the Linde Air Products Co. The whole sample corresponded to 60 to 70 million liters of air. Part of the sample was isotopically enriched in T by standard electrolytic methods by a factor of ~7. A theory is proposed for explanation of the high T concentration found. (L.M.T.)

URANIUM AND URANIUM COMPOUNDS

2732
HERTZIAN SPECTRUM AND STRUCTURE OF SOLIDS. III. PRELIMINARY RESEARCH ON THE NON-STOICHIOMETRIC COMPOUNDS: URANIUM OXIDES. M. Freymann, S. Langevin, M. T. Rolland-Bernard (Faculté des Sciences de Rennes, France) P. Perio, and R. Kleinberger (Service de Chimie Physique, Paris, France). J. phys. radium 15, 82-91(1954) Feb. (In French) (cf. J. phys. radium 14, 203(1953))

The four typical examples of U oxides, UO_2, $UO_{2.25}$, U_3O_8, and UO_3 show some very different dielectric properties (absorption and dielectric constant as a function of the temperature and the frequency). It is shown that, in general, the absorption–temperature curves of U oxides show two distinct maxima. One, at the lower temperatures, forms a Debye absorption. It is believed that the corresponding dipoles arise from lattice faults. The other maximum, at room temperatures, shows Debye absorption, but displays a hysteresis phenomenon. The influence of the frequency used (200 cps to 1 Mc), of the O content, and of the crystalline structure on the curves ϵ' (T) and especially on ϵ'' (T) was studied. The results are reported on the basis of Log ν_c (1/T). The variations of the U activation energy of the lattice faults are derived as a function of the O content; this energy of activation is a minimum for a composition approximately $UO_{2.25}$. It is at this composition that the microwave absorption is a maximum (λ = 3.14 cm). (tr-auth)

Notice

It has been necessary to omit the author index usually included in this issue. A cumulated author index for Vol. 8, Nos. 1-12A will appear in No. 12-B, dated June 30, 1954.

NUMERICAL INDEX OF REPORTS

Numerical Index of Official Atomic Energy Reports with Indications of Their Availability

This list supplements the Numerical Index of Reports which appears in NSA, Vol. 7, No. 24A; the cumulative list in NSA, Vol. 8, No. 8; and lists in individual subsequent issues.

It contains the report numbers and corresponding abstract numbers for all research and development reports in the current issue. In addition, it also contains all availability information located since the preparation of the latest preceding issue. The notation NSA in the availability column indicates the appearance of a report in its entirety in NSA.

In order to help identify the non-AEC originator of each series of reports, a significant word has been placed in parentheses beside the code. No parenthetical word is shown for series of reports issued by the USAEC.

Information concerning the location and acquisition of these reports appears in the Introduction to this issue.

Abbreviations used below are:

NSA - NUCLEAR SCIENCE ABSTRACTS
ADD - ABSTRACTS OF DECLASSIFIED DOCUMENTS the predecessor of NSA
NNES - National Nuclear Energy Series, published by the McGraw-Hill Book Company

Code designations are assigned as follows:

MDDC - To declassified reports released by the Manhattan Engineer District and by the Atomic Energy Commission before March 1, 1948
AECD - To declassified reports released by the Atomic Energy Commission after February 29, 1948 (appeared in April 15, Nuclear Science Abstracts)
AECU - To unclassified reports originating within the Atomic Energy Project. (Subsequent to AECU-871, this code is applied only to reports carrying no other recognized code designation.)

Other code designations below are assigned to unclassified reports by the originating installations

Report	Abstract	Availability
AD (Non-AEC)	NSA	
5092	8-2709	
13776	8-2413	See WADC-TR-53-145
AEC-tr		
82	8-2330	
1622	8-2390	
1625	8-2331	
1719	8-2398	
1767	8-2521	Associated Technical Services (Trans: No. 50E2F-A; 50E2F-B), East Orange, N. J.
1768	8-2488	Associated Technical Services (Trans: No. 51E2F), East Orange, N. J.
1769	8-2603	Associated Technical Services (Trans: No. 52E2F), East Orange, N. J.
1783	8-2407	
1787	8-2454	
1788	8-2332	
1790	8-2373	
1812	8-2399	
1816	8-2489	
1817	8-2490	
1818	8-2333	
1819	8-2491	
1820	8-2520	
1821	8-2347	
1822	8-2334	
1823	8-2380	
1824	8-2381	
1825	8-2382	
1826	8-2383	
1827	8-2384	
1828	8-2385	
1829	8-2386	
1830	8-2375	
1831	8-2492	
1832	8-2335	Henry Brutcher (Trans. No. 3072), Altadena, Calif.
AECD		
3311	6-1649	Anal. Chim. Acta 10, 178-81(1954)
3516	7-3036	Anal. Chem. 26, 267-71(1954)
3523	7-4147	J. App. Phys. 25, 324-31(1954)
AECD		
3613	8-2686	
3616	8-2430	
3617	8-2541	
AECL (Canadian)		
94	8-2730	See CRP-560
AECU		
2414	7-1905	J. Cellular Comp. Physiol. 42, 471-85(1953)
2423	7-2347	Rev. Sci. Instr. 25, 115-19(1954)
2431	7-2348	Rev. Sci. Instr. 25, 164-69(1954)
2610	7-5288	J. Immunol., 72, 119-22(1954)
2634	7-5644	J. App. Phys. 25, 344-9(1954)
2655	7-6638	Phys. Rev. 93, 463-70(1954)
2686	7-5992	J. Aeronau. Sci. 21, 59-60(1954)
2687	7-6623	Phys. Rev. 93, 483-97(1954)
2702	8-393	Phys. Rev. 93, 413-18(1954)
2714	8-405	Phys. Rev. 93, 253-4(1954)
2726	8-87	J. Am. Chem. Soc. 76, 1119-22(1954)
2743	7-6621	Phys. Rev. 93, 1056-8(1954)
2755	8-2254	$0.20
2758	8-1227	Phys. Rev. 93, 1086-93(1954)
2765	8-2272	$0.70
2795	8-2479	
2800	8-2690	
2807	8-2626	
2812	8-2197	Nucleonics 12, No. 3, 24-8(1954)
2818	8-2400	
2819	8-2596	
2822	8-2691	
AERE-C/R (British)		
1241	8-2355	
1311	8-2344	
AERE-E/R		
1291	8-2361	
AERE-ED/R		
1302	8-2412	
AERE-EL/M (British)		
85	8-2542	
AERE-GP/M (British)		
161	8-2650	